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# GAS JOURNAL

## LIGHT • HEAT • POWER • BYE-PRODUCTS

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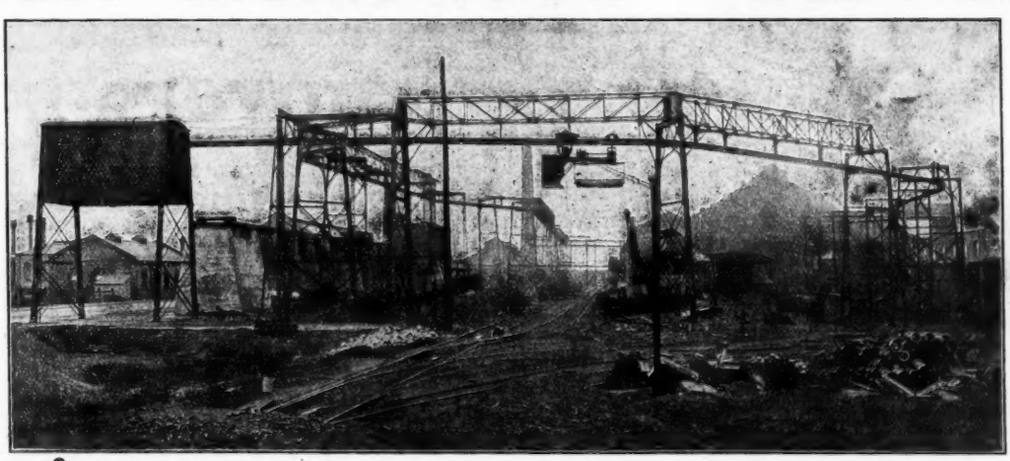

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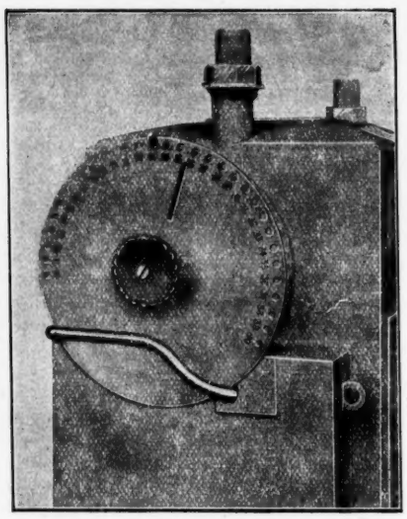

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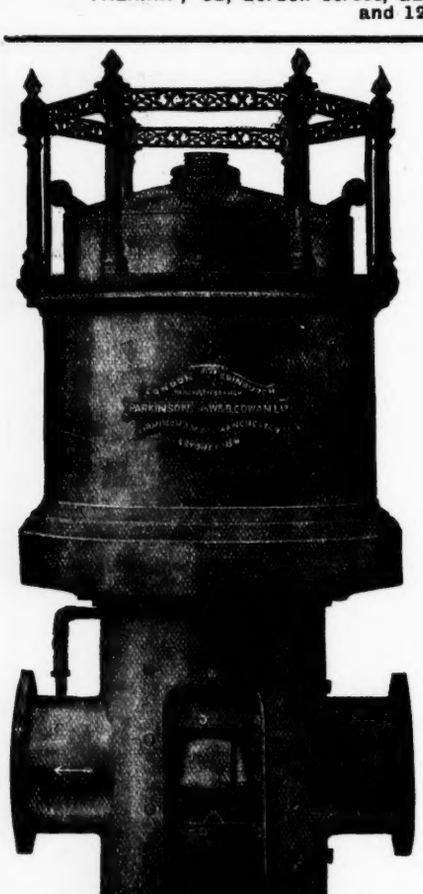

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[Founded in 1849 as the "Journal of Gas Lighting."]

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

VOL. CXLVI., No. 2920.] TUESDAY, APRIL 29, 1919. [71ST YEAR.


## EDITORIAL NOTES.

### A New Charter for the Gas Industry.

A NEW charter for the gas industry has been prepared. It is embodied in the anxiously awaited report [see p. 238] of the Fuel Research Board upon the reference made to them by the Board of Trade, who sought the advice of this tribunal as to what is the most suitable composition and quality of gas to supply for general use, and the minimum pressure at which it should be generally supplied, having regard to the desirability of economy in the use of coal, the adequate recovery of bye-products, and the purposes for which gas is now used. Though long-awaited, it cannot be said that—in view of the vastness of the ground which the investigators had to cover, the many interests they had to consider, and the necessity of passing final judgment on statutory enactment in relation to progressive needs—Sir George Beilby and his colleagues have been dilatory in their work. Their report is a remarkable and epoch-making one for the gas industry; and its recommendations are those of men of independence and competence in the matters referred to them. The value of this is incalculable; for from the beginning the affairs of the industry have been legislated upon by the tribunals that, however just they (politically obsessed) may have tried to be, have not, through lack of scientific and technical qualification, been able to take a broad view. Here we have a report which is a condemnation of the statutory standardized servitude of the industry, which has been fatal to the attainment of the highest efficiency, and to the exercise of the spirit of progress. The members of the Board speak plainly and with unanimous voice: "So long as the technical staffs of the gas under-"takings are compelled to narrow their outlook, and limit "the exercise of their imagination, by the prime necessity "of conforming to a stereotyped standard evolved to suit "average conditions, and having no direct relation either "to the needs or the resources of their own district, so "long will they be compelled to lag behind in the indus-"trial race."

Never again after this report will Parliament, or any of its Committees, be able to say that the industry has been statutorily governed in an enlightened manner, nor will they be able to defend the continued strangulation of the industry by persisting in harnessing it by inflexible standards. Parliament has hitherto largely proceeded on the mistaken notion that the interests of gas producers are antagonistic to those of consumers. No such absurd fallacy has place in the minds of the members of the Fuel Research Board. They, as both scientific and practical men, know full well that the interests of gas producers and consumers are identical; and not only so, but that, in legislating mainly for the supposed interests of the consumers, there has been on the part of Parliament a deplorable negligence of the national interests. The truth of this has been established more firmly than ever during the war; and the report now invites the Legislature to look facts straight in the face, and to legislate with due consideration for every factor that bears upon the situation. The report breathes freedom; and it advocates freedom—save in respect of inerts, sulphur and cyanogen impurities, and pressure. So far as it advocates freedom of action for every gas undertaking in selecting the calorific value of the gas it shall produce, with opportunities for revision, it is more than a ratification of the desire of the industry to develop on sound lines "its possession of the "cheapest known means of distributing potential heat energy "in a convenient form." If general legislation is promoted, as we hope it will be, to give effect to the report (perhaps in some respects modified), there is no question that it will greatly simplify all subsequent Private Bill Legislation for the industry, to the ultimate benefit of all concerned.

The Board do not answer the question as to what is the most suitable composition and quality of gas, having regard to the desirability of economy in the use of coal, and to the purposes for which gas is now used. They cannot, eminent and well qualified as the members are. Parliamentary committees and local authorities wholly without, or with less, qualification, have done otherwise. The members of the Board know that no general standards can be fixed, which can apply to all coals, and to all local conditions, embracing plant and the diverse applications of gas, if the maximum of progress is to be made and utility served. Economy and progress unite in crying out against the application to practice in gas supply of any such theory as general standardization. The facts that our air is still defiled by smoke, that labour-creating coal is still so extensively used in our households and industries, and that labour-saving gas has not made the progress that it should have done as the cheapest known means of distributing potential heat energy, attest that there has been failure of the limitations imposed by statutory enactment to encourage the development of the most suitable gas for the service of the community and of industry.

This brings us to the cardinal feature of the report, which proposes a fundamental change for the industry, abrogating all necessity for any general fixed standard of composition or calorific value, other than the calorific value selected by the undertaking concerned as being the most suitable under its own conditions. The proposal (which will now have to be very carefully considered by the industry) is simply that, instead of being charged for the number of cubic feet of gas used, the consumer should be charged for the actual thermal units supplied in the gas passing through his meter, by multiplying the registered number of cubic feet by the calorific value per cubic foot. The advantages would be more of a collateral nature than direct as the basis of a business transaction. The change has lately been discussed. Much has been said in favour of it; little against it. More in favour will be found in the report. Among other things, it would result in gas undertakings aiming for the maximum production of B.Th.U. per ton of coal, within the limits of their own selected value per cubic foot, which value would be open to variation by specified notice, and the performance of certain obligations, which would require a staff of inspectors for the adjustment of consumers' appliances for the ordinary purposes of domestic lighting, heating, and cooking, so that the gas could be burned in these appliances with safety and efficiency. Readjustment in all cases could not possibly be complied with immediately. The consumers' appliances are not all fitted with gas and air adjustments which the Board properly regard as highly essential; and such adjustments (the absence of which has been the cause of some of the trouble during the war) would take time to provide. Nevertheless, the proposal would be of great value to the industry. The obligation to regulate is a fair concomitant of freedom of production; and past experience assures us that it will be to the permanent interest of the industry to have this responsibility placed upon it, albeit it means an extra cost. But in order to save money in industry, money must be expended.

Another advantage of the closer intimacy that would be set up between gas undertakings and their customers would be the opportunity that would be afforded of recommending the types of appliances which would yield the highest efficiencies, because, though the parity of B.Th.U. is tentatively accepted by the Board in the absence of complete experimental proof under different condition of gas composition,

it is recognized that the "availability" of the heat developed varies with the suitability or otherwise of the conditions under which it is used. It is because of this that the Board express the desirability, before any legislation is undertaken, that representatives of gas consumers and producers and the makers of fittings and burners should jointly decide on the standardization of burners and appliances for a limited number of calorific values. It is suggested in the report that initially four standards may be sufficient—400, 433, 466, and 500 B.Th.U. This suggestion is most interesting, because the 400 B.Th.U. level shows that the Board have pretty liberal views as to the margin of choice that should be allowed to gas undertakings even at the outset. With correct nipples for the quality of gas, gas and air adjusters already in existence are quite capable of dealing with gas of calorific values between the top and bottom figures. But gas and air adjusters are, unfortunately, not yet in universal use. It must be the business of the gas industry to correct this, with the aid of the manufacturers. In addition to the undertaking's own inspectors, every gas-supply district would have to possess its official gas examiner, or perhaps a group of small towns could jointly employ a single examiner. The report, however, is not altogether clear whether the charges to the consumers would be based on the selected minimum calorific value per cubic foot, or on the average of the gas examiner's returns.

It has been mentioned that the members of the Board see a complete interconnection between gas producers', consumers', and national interests. They are, in fact, inseparable, except by the violent application of ignorance. National interests—always hitherto neglected when Parliament has been invited to consider the affairs of the industry—will, it is recognized, be best served by the policy which will promote the widest possible adoption of scientific methods for the preparation and use of fuel. The conservation of coal by the industry, and the use of coal by it which, according to geographical situation of the concern, will give the best economic results, are in the national interests. The steaming of charges, the blending of coal gas with water gas, and the purchase of coke-oven gas, are therefore in the national interests. With the system of charging proposed, and the safeguards which will give consumers the best efficiency from the gas supplied, there is not only abundant protection for the consumers, but, in utilizing all resources for the production of combustible gas, a contribution to national economy will be made. A good word is also said in the report for benzol extraction, in view of the demand for home-produced motor spirit. Then, again, the new basis of charging on the actual heat energy supplied will enable the gas industry to better develop the supply of industrial gas, stimulate its use, and encourage manufacturers to fully concentrate about the gas-works. There is quite prominent reference in the report to this possible development in the interests of industry generally; and this is not surprising in view of the technical knowledge of industry possessed by the members of the Board. Blue water gas has very favourable mention in this connection. It is in one place described as an "ideal "gaseous fuel." In another place, it is referred to as "one "of the finest and most manageable of fuel gases for indus-"trial purposes," and "it would pay in certain cases to dis-"tribute it over a fairly wide area." For gas supply for general purposes, water gas, whether it is made by steaming retort charges or in a separate generator, is characterized as a natural diluent, and is favoured for producing such blends of combustible gas as are found to be most economical.

Here comes a point regarding the closely drawn limitation of inerts over which there is bound to be some controversy. Among the recommendations is that gas undertakings should be free to supply any mixture of ordinary combustible gas, free from sulphuretted hydrogen, and not containing more than 12 p.ct. of inerts; and that the minimum pressure should not be less than 2 inches at the exit of the consumers' meters. Not among the specific conclusions, but appended to them, there is also a clause urging that the more complete removal not only of sulphur compounds, but of cyanogen compounds, should be kept well in view. This last-named matter opens up a much larger question, and presages additional work and outlay. The pressure recommended will also cause a little flutter in those districts where the distribution systems have not, partially due to war conditions, been developed *pari passu* with consumption, and particularly on the outskirts. But the 12 p.ct. limitation of inerts will be the critical and controversial point. True the proposed transfer of the base of charging from cubic feet to heat energy removes from gas producers all inducement to them to dilute gas by the addition of incombustibles, and would encourage the use of gas which will bring into account more B.Th.U. per ton of coal handled. With care at the carbonizing plant (providing it is in good condition), and in the making of the water gas, there would be no difficulty, in a few cases, to immediately comply with this restriction; but in other cases it will be impossible to do so for some time to come. It is a limitation trimmed too close to be generally comfortable or applicable at present; and it will deprive some undertakings of part of the liberty which it is the avowed desire of the Board should be conferred. The Board have met with many leading gas engineers who have expressed strong disapproval of the practice of diluting good gas by inert gases; and the Board will probably hear much disapproval from certain other quarters of their remark: "We "are not aware that any engineer of standing would be pre-"pared to defend it seriously." Time will show, but after seriously we would add the words "and effectively."

The importance of this report to the gas industry cannot be emphasized too much. It represents (perhaps with exceptions of relatively minor importance) the ideals of the gas industry; and we hope the Board of Trade will take early action upon it. If not, the industry must press the matter, because, as the Board will readily recognize, it opens-up the way to the realization of the ambition to develop into larger service. It represents the first issue in definite work of the Fuel Research Board, who are "hopeful that the producers "as well as the consumers will realize the value of the pre-"sent opportunity for the establishment of more effective "co-operation; and, in arriving at the proposals we have to "make, we have had this ideal always before us."

## Gas Production and Prosperity.

In a little book entitled "From War to Work," there is much that is philosophic from the clear and perceptive brain of Mr. Samuel Turner, the well-known author upon industrial matters. A large part of the contents is applicable to the gas industry in these times when it is essaying to harmonize its technical and commercial work with new conditions—conditions not limited to higher costs of materials, goods, and labour, but extending to the general service and well-being of the community. It would not be beyond our province to dip deeply into the book; but our pages have their limitations. There are, however, two or three sharply defined and pregnant phrases which can be picked out and applied to the work that is enthusiastically proceeding in some quarters, and to the confusion there is in other gas men's minds as to the course they should pursue.

"Prosperity," we read, "depends upon consumption; and "high consumption is impossible without high production." No one will dispute the first part of this quotation. As to the second part, when considered in relation to current and prospective costs in the gas industry, it is manifest that the only definite way of moderating costs (other than to a relatively small extent) is by high production per ton of coal; and only by moderating costs can a lower charge be made for the commodity, and thus a higher consumption be fostered and secured, to bring in turn its impression to bear upon the reduction of general costs. Coal has gone up in price, so have all materials and manufactured goods, and so has labour; and they are not coming down again to the old levels. What has therefore to be done? The industry has to utilize to the best possible advantage the capital it employs; it has to make the utmost serviceable gas out of the coal it purchases; it has to put all the manufacturing plant to the best possible use; it has to make the distribution system convey in the form of gas as many B.Th.U. as possible; and it has to offer the best inducement to householders and industries to use gas-consuming appliances for all possible purposes, and to the maximum of their requirements for light, heat, and power, and as many of these appliances as their needs demand, to the displacement of agents that are less efficient, less economical, or which involve more labour. All these are ways in which, according to internal conditions and opportunity, increased outlay on the part of a gas undertaking can be, if not counterbalanced, substantially diminished; they are all the ways to greater prosperity. But not one of them, let alone the whole of them, can be served without reference to production per ton of coal handled. Production stands at the head and front—not production in cubic feet per ton, but production which means the transfer from the coal into serviceable gas of as

much as possible of its calorific value. A high price has to be paid per ton of coal; the coal has to be handled by plant which initially would, and for maintenance does, cost more than formerly; and the labour employed upon the coal from delivery to retort also costs more. But if we can get out of the coal, by the utilization of a comparatively small part of the coke, 8 to 12 million B.Th.U., instead of 6 millions, the costs are all along the line reduced per million (or any other unit) B.Th.U. put into the gas-mains.

"We have to choose whether we will travel the path "towards our social ideals with the benefits of high pro- "duction or the penalties of low." Perhaps Mr. Samuel Turner's word "social" should be preceded by "industrial "and" for our particular purpose, seeing that the ideals of the industry are of both orders. The benefits of high gas or B.Th.U. production (having regard to gas uses) are of a very tangible kind; and so are the penalties of low production. What during the war would have been the condition of gas undertakings that were, not many years since, getting from good class gas coals about 10,000 c.ft., or slightly more, per ton carbonized, had they not been in a position to make 12,000 to 12,500 c.ft. or more per ton during the stress of the years through which we have been passing? Bad as have been these times, they would have been much worse. The extra 2000 c.ft. have been a great help; and so has all that has been brought into account through steaming or water-gas production. We see, too, that where the steaming of retort charges has been possible, or where well-made water gas has been mixed with coal gas, the charges to consumers (relative to pre-war prices) have been lower in comparison with pure coal gas undertakings. The differences have not in all cases been great; but there have been differences which have demonstrated potentiality when plant can be converted and production systematized. Experiences in respect of the effect upon costs have varied, as between different places, according to the degree to which modern knowledge could be applied. But it is beyond question now that a high production, expressed in terms of B.Th.U. per ton of coal, within the (as yet) undetermined limits set by suitability of the gas to purposes, is the way by which the greatest measure of financial relief and expansion of business is to be obtained by gas undertakings. During the war, too, the elasticity of productive capacity imparted by steaming and the utilization of water gas has proved a valuable asset to gas undertakings—not only in the effect it has had in altering the ratio of coal purchase, transport, delivery, and handling to gas output, but in meeting at the least possible cost sudden flights in demand. So far as we are aware, no straight coal gas concern down South has been able to reduce the price of gas since the armistice; but round about London there have been companies who have made some reduction. It is freely acknowledged that there is scientific reason for slightly carburetting water gas, made separately, for admixture with coal gas. Last year the Gas Light and Coke Company used an average of only 0·82 gallon of oil per 1000 c.ft. of water gas made; but due to the lower price of oil now, they have been able to bring down the price of gas throughout their extensive district by 2d. per 1000 c.ft. This would mean on last year's gas sales a difference to the consumers of roundly £220,000. The penalties of low production per ton of coal carbonized include the absence of similar elasticity. As measured by to-day's knowledge, a low production of gas per ton means a high production of B.Th.U. per cubic foot, but a limited production of cubic feet and B.Th.U. per ton of coal, and deprives an undertaking of part of what would otherwise be its manufacturing, financial, and business development potentiality.

"The law, however obscure, is that the consuming power "of the world expands incalculably when commodities are "placed within its reach at a price which it is possible for "the many to pay; and the amount of labour employed "becomes incalculably greater when this general consump- "tion takes the place of the extremely limited consumption "where the price confines the use of the product to the "few." In the gas industry it has been the pride and boast of many managers that they are "low-price men." Though their prices may be relatively high to-day, they are still at heart low-price men; and they realize the trading value of a low price. If anything, with prices "up" for all commodities, there is greater attraction than ever in a low price; and its power in development will be beyond measure. Whatever be the basis of charge in the future, gas undertakings must get their prices down as low as their producing resources will enable them to do, in order to obtain the maximum possible development of business. A lay consumer would only smile indulgently on the gas man who told him that gas of one calorific value at 4s. per 1000 c.ft. was of more use to him than gas of (say) another calorific value selling at 2s. 6d. It is not the slightest use telling a consumer that 10,000 B.Th.U. for 1d.—with 500 B.Th.U. gas at 4s. 2d.—are more valuable to him than 12,500 B.Th.U. supplied for 1d. if 450 B.Th.U. gas is being sold at 3s. per 1000 c.ft., or 13,333 B.Th.U. for 1d. if 400 B.Th.U. gas is being sold at 2s. 6d. The consumer can understand value expressed in quantity and price; he cannot understand the theoretical latent values which are presented for his edification from some quarters. The fact remains that a consumer is more willing to buy a commodity and plenty of it at a low price than he is the same thing at a high price. This is true of every commodity. The attractive value of a low price does not stop there. It not only enlarges business with the individual consumer, but it extends business to more consumers. For heating, we are not likely to get so many gas-fires connected-up with gas at 4s. as at prices receding from that figure, though the calorific power per cubic foot may be less, but the B.Th.U. supplied per penny may be more. In the matter of wealth, there are more people in the lower strata than there are in the upper; and to the majority of people price counts for much. So does value; and more heating value can be supplied for a given sum where the best possible transference of B.Th.U.'s is made from coal to gas.

The extension of gas consumption through making the best of production per ton of coal does not end its benefits with the gas supplier; it extends them to manufacturers of gas plant and appliances. With greater gas or B.Th.U. production per ton, the demand for plant and appliances will be multiplied indefinitely. More producing and distributing plant will be required; more gas-cookers, more gas-fires, more water-heaters, more gas-furnaces, more gas-engines, and more of the other countless things in which gas is the agent of utility. In every part the industry will expand, the cheaper its prime commodity. The elementary truth is that "the basis of all prosperity is production, that every- "thing which promotes this is to be welcomed, and every- "thing which diminishes it will infallibly injure real inte- "rests in the long run."

## Promoting the Efficiencies and Serviceability of Gas-Cookers—A New Type.

Until a comparatively few years ago, the gas industry had nothing much of which to boast as to scientific methods. It was the same in gas utilization as in its manufacture. But in both progress has of late years, through scientific aid, been making long strides. The question of gas manufacture is not before us at the moment. It is its utilization to which attention is called by an article which describes the new "Eagle" gas-range that has been developed by Messrs. John Wright & Co., and in which we see are suppressed some of the old mistakes which were made by indifferent, or an actual want of, knowledge of certain elementary scientific principles. Looking back generally over the appliances for the utilization of gas that reigned for long years, they all seem to have been originally designed with the view of providing the easiest means of construction and use, with no apparent regard to efficiency; and, weighed in the balance against current information, much inefficiency, waste, and objectionable result obtained. To structural design, whatever the types, the manufacturers showed a most dogged determination to adhere, until the recognition of the value of scientific investigation began to flow into the industry, and the manufacturers themselves commenced to realize that there must be a parting from the old ways. Now, to-day, in addition to what the industry collectively and gas undertakings individually are doing, manufacturers of gas-heating appliances of every description are ardent prosecutors of research. The gas-fire was the first to feel the effect of this change, to the great advantage of both the gas-supply industry and the manufacturers, although even among the fires of to-day all types of some makers have not attained the perfection that is possible, and that the user has a right to expect. Gas-furnaces and water-heaters were more fortunate in their coming; for the outlook upon essentials was broader, and the opportunity for investigating them was already at hand. But the gas-cooker and its boiling and grilling accessories were very much neglected until

shortly before the war, though here and there among the makers new ideas had led, and were leading, to changes—not omitting reference to the successful externally heated ovens. The war, however, interrupted development in these directions—development which would have been established years before had scientific research and principles only been brought to bear earlier. But they had not.

Now, however, the matter has been attacked very seriously; and the article in other columns shows that a breaking-away from past custom and tradition has set in. The new "Eagle" gas-range incorporates features which merit approval, because the range rectifies mistakes of the past, gives to the user an increased efficiency (which means the saving of gas), and extends serviceability, while departing from the old designs. With all its defects, however, the gas-cooker has become very popular in the homes throughout the land of rich and poor alike, because of its convenience and economy relative to other agents. With greater efficiencies and serviceability, the distance in superiority is lengthened between the gas-cooker and the electric-range; and the coal-range, formerly largely out of the running, is more so now. Considerable scope has existed for raising efficiency on the hot-plate, and doing something to obviate waste. Sir Dugald Clerk, at the autumn meeting of the Institution of Gas Engineers, gave it as his deliberate opinion that the efficiency of boiling-rings could be raised by 20 to 25 p.ct. without much difficulty. One of the mistakes of the past has been the presence of bars over the boiling-rings, which not only prevented full contact of the jets on the bottoms of the utensils above, but acted as routes for the dissipation of heat by all the means—radiation, convection, and conduction—by which it can be diverted from its proper function in this case. Mr. Frank Livesey, in his recent Southern Association address, pointed out that with the old "Maidstone" cooker, without cross-bars over the burners, he was able to realize 15 p.ct. higher efficiency than from an ordinary hot-plate boiling-ring. Thus this is an instance where a structural blunder, resulting in continuous waste, might have been avoided by elementary scientific considerations. On the hot-plate of the new "Eagle" range, there is no interruption to flame contact with the utensils; and so there are no unnecessary channels for the transmission of thermal energy from its destined purpose. Another point about boiling-burners which we could never understand, is their excessive diameter, together with widely spaced jets of large volume, which allowed a tailing-up the sides of kettles or pans, causing further waste of gas, and sometimes offence to the olfactory organs. On the new range, the rings are smaller, with short intense jets, which concentrate themselves comfortably underneath the vessels, without interference with the aeration of the flames. Some of the burners are of duplex form, with a tap-lever, which when "full-on" allows the whole burner to be alight, or when half on only permits a simmering-burner to be in action. The convenience of this is patent. From these observations it will be seen that a higher efficiency is obtained, and gas is saved. When too, the work is done at a quicker rate, the time within which losses of heat can take place is shortened, so that here dual economy of gas and time can be claimed. The grill is also arranged with a tap-lever for variable heats. Another important matter in these times when the industry is on the brink of large changes in gas manufacture, is that all burners are fitted with gas and air adjusters, which is a point that is made in the report of the Board of Fuel Research. With the new boiling-burners tests have, we are informed, been made with gases varying from 350 to 600 B.Th.U., with results which show that the burners and adjustments compass any gas likely to be distributed for public use. In this connection we should like the actual percentage efficiencies to compare with those in the Gas Investigation Committee's report.

There are in the oven novel features, which produce conservation of heat, and enable the whole cubical capacity to be utilized. The oven has a solid bottom plate, with the burner beneath, which combined contributes to uniform heat distribution through the oven. The regulating tap-lever is also used for the burner, so that when the oven is properly heated, the flames can be brought down to a point at which a sufficient temperature will be maintained. The structural changes which put users in possession of greater convenience are many, and are specifically described in the illustrated article in other columns.

We are not prepared to say this is the last word in cooker design or improvement. Messrs. John Wright & Co. would not wish us to do so; nor would their research department. But what can, with every confidence, be said is that a successful attack has been made on fallow ground where the opportunities for higher efficiencies have long existed, and that, as a result, a genuine advance has been made in the promotion of gas cooking economy and convenience through a cooker which will to the householder carry commendation by its external appearance and features, even without those other considerations which all technical and commercial gas men know to be much more important.

## The Electric Schemes and Heating.

It is time that something of an effective nature was done to inform the country from North to South and East to West of the folly that exists in political places at Westminster, and is strongly fostered by highly coloured reports and intrigue, in supposing that big super electricity stations and expensive distribution are going to supply all human needs in regard to light, heat, and power at prices that will be as near neighbours to a *minus* quantity as can be conceived, and are going in the savings [?] to be effected to cause a golden harvest to be reaped by the nation. All that has been done up to the present to help to correct the misinformation has reached a comparatively limited number of people; and this is not enough. The National Gas Council has sent a circular letter to the technical and general Press of the country calling attention to the important statistics recently laid before the Society of Arts by Sir Dugald Clerk, in his paper on the "Distribution of Heat, Light, and Power by Electricity and Gas." We are not aware whether a copy of the paper itself accompanied the letter. If not, the letter will not carry so much weight as it would otherwise have done. However, the communication suggests that the statistics should be taken into careful consideration by the Government before making any move to foster the use of electric energy as a heating agent. The gas industry has no desire to take any unfair advantage of their greater thermal efficiency, and the better productive use to which they put the coal they employ. It is fully admitted that the provision of an ample and cheap supply of electrical energy for light and power is of great importance to the industries. In these matters, the consumers' choice of gas or electricity can depend solely on cost and suitability. In regard to heating, the position is different. By any and every means of comparison, it is clear beyond dispute that the most deplorable waste of coal is entailed in the use of electricity as a source of heat, which waste can be avoided by the use of gas. However, the circular letter draws attention to salient facts which will strike interested editors as being worthy of the attention of themselves and, through them, the public.

## Commercial Officers and Clerical Assistants.

The technical officials of the gas industry tarry while the officials of other industries are gaining strength by union to protect their interests, and to obtain just recompense for services rendered. We regret that the necessity exists for this; but as it does exist, and as there appears to be only one remedial way, it is the way that must be taken. It has been seen that electrical engineers were before gas men in making a move in this direction, and not only so, but in establishing an Association. The electrical industry, indeed, now seems to be unionized from top to bottom. The last thing is an amalgamation of the forces of the Chief Commercial Officers' Association (Electricity Supply Undertakings) and the Clerical Assistants' Association (Electricity Supply Undertakings); and the result is the Electricity Commercial Association. From electrical commercial officers and clerical assistants, the new organization has a membership of 2000, which number is being rapidly added to. In addition to the London Branch, the Association has branches at Birmingham, Dewsbury, Edinburgh, Newcastle-upon-Tyne, Bristol, Liverpool, and Derby. If numbers go for anything, this is a strong body whether the measure of its influence is equally great, we have no means of knowing.

Two further pamphlets of the series of "Reconstruction Problems" have been issued by the Ministry of Reconstruction. No. 18 deals with Industrial Councils under the Whitley scheme, and No. 19 with State regulation of wages. They are published by His Majesty's Stationery Office, price 2d. each.

# THE GAS INDUSTRY'S CASE ON COAL CONSERVATION.

Prepared by Sir Dugald Clerk, K.B.E., D.Sc., F.R.S., M.Inst.C.E., Prof. Arthur Smithells, C.M.G., F.R.S., and Prof. John W. Cobb, C.B.E., B.Sc., F.I.C.

At last Thursday's Council meeting of the Institution of Gas Engineers—referred to in another column of this issue—the report to the President of the Institution (Mr. Samuel Glover, of St. Helens) on Coal Conservation and the Coal Gas and Electrical Supply Industries of the United Kingdom, by Sir Dugald Clerk, K.B.E., D.Sc., F.R.S., M.Inst.C.E., Prof. Arthur Smithells, C.M.G., F.R.S., and Prof. John W. Cobb, C.B.E., B.Sc., F.I.C., was presented and adopted. The Secretary (Mr. Walter T. Dunn) was instructed to forward the report to the National Gas Council, in order that it might be placed, with any supplement, before the Government and the Ministry of Reconstruction, as representing the considered views of all sections of the gas industry. We have received a copy of the report; but at the time of going to press with this number there is no opportunity to do more than indicate the matters covered by the report and give the general conclusions which are arrived at therein.

In a letter to the President of the Institution dated the 14th inst., the reporters state that, in accordance with instructions, they have made an examination of the position of the coal-gas industry in relation to fuel consumption, and have, with the best information at their command, brought it into comparison with the corresponding position of the electricity supply industry, in order that any proposed substitution of electricity for gas in the supply of heat, light, and power may be clearly viewed in relation to the question of coal conservation. Details of the examination are set forth in the report; and in the letter the following brief summary is given of the general conclusions which are detailed below:

1.—If the whole of the heat expended on the carbonization of coal be debited to the coal gas which is produced, then, of every 100 units of heat so expended at the gas-works, 45 are conveyed to the consumer in the supply of gas.

2.—At the present electricity stations of the United Kingdom, of every 100 heat-units expended by the combustion of coal for the generation of electricity, 7·6 are available for the consumer.

3.—In the best existing undertakings for gas and electricity, the figures are altered as follows: For gas, 52; and for electricity, 12.

4.—In the proposed super-station, the conjectural figure for electricity is approximately 18. With improved practice of coal carbonization, the corresponding conjectural figure for gas is about 75.

5.—For heating purposes, except where temperatures above 1700° C. are required, gas is vastly more economical of fuel.

6.—For lighting and power production, a comparison of the thermal efficiency of fuel consumption in the case of gas and electricity does not give a dominating claim to either.

The letter concludes: "We are strongly of opinion that the maintenance and development of the gas industry are essential in the interest of fuel conservation, apart from all other considerations."

## The Scope of the Report.

The report, with its appendix, extends to nearly forty foolscap pages, and is divided into two parts. Part I. deals with present practice, and Part II. with future development. A brief historical introduction is followed by consideration of the coal consumption and thermal efficiency of gas and electrical undertakings. The heat consumption required to produce light by gas and electricity is shown; and then the two sources are compared. Another section covers a comparison of gas and electricity for heating and power; and after this there are conclusions as to coal or heat conservation.

This brings us to Part II. (on future development), which first of all deals with methods of increasing the thermal efficiency and gas output of gas undertakings. There is also a comparison of gas and electricity of the future, from the discussion of which it is said: "It is obvious that large savings may be effected in existing gas-works by combining electricity supply with gas making and distribution without materially altering the analysis and modes of generating coal gas at present in use." The heading to the section which precedes the general conclusions is the "Financial Effect of Increased Proportion of Total Heat of Coal in Gas Delivered into Station Holder."

## General Conclusions.

These are the general conclusions arrived at:

1.—At present the gas-works of the United Kingdom carbonize 20 million tons of coal per annum, producing town's gas, coke, tar, and other bye-products, with a thermal efficiency of from 70 to 80 p.ct. Even regarding gas as the only useful product, and after allowing for transmission and all other losses, the consumer receives as inflammable gas at least 45 p.ct. of the heat value of the coal which has been used at the gas-works to produce and distribute it.

Out of every 100 heat units in the coal used at the gas-works, 55 are reckoned as lost in the process of gas-making and distribution, and 45 are available for the use of the consumer.

2.—At present the electricity generating stations of the United Kingdom, including electric railways, deliver 7·6 p.ct. of the heat of combustion to the consumer. The boiler loss, turbine loss, thermodynamic conversion of heat into work and transmission loss account for over 92 p.ct. of the total heat.

Out of every 100 heat units produced by combustion in the central station boiler furnaces, 92 are lost as above described, and only 7·6 are available for the purposes of the consumer.

3.—*Gas thus distributes 45 units of heat out of 100 at the gas-works, instead of 7·6 units of heat out of 100 consumed at the central station to produce electricity.*

4.—At present the best existing electricity generating undertaking in the United Kingdom delivers 12 p.ct. to the consumer and loses 88 p.ct.

Electricians promise for the future super-stations a delivery of 17·6 p.ct. Here the loss is 82·4 p.ct.

5.—At present the best existing gas practice in the United Kingdom delivers about 53 p.ct. of the heat in the coal used at the gas-works to produce it, and only loses 47 p.ct. in the work of generation and distribution to the consumer.

In the early future, all gas-works could distribute as gas to the consumer one-half of the whole heat of the coal carbonized, leaving 33½ p.ct. of the whole heat in the unused coke and tar, thus realizing the high thermal efficiency of 75 p.ct. in the gasification process.

6.—*Thus, in the future, gas might be expected to deliver 75 heat units out of every 100 as compared with the 17·6 to be delivered by the prospective electricity super-station.*

7.—Except where temperatures above 1700° C. are required, electricity, even in the future, is extremely wasteful of fuel when applied to supply heat. Gas is many times superior in the great mass of heating operations.

8.—For lighting and power production, electricity in the future promises results which compare more favourably with gas. But even here the higher efficiency of the gas-engine as compared with the steam-engine, the future economies in sight in the production of gas, and its use with incandescent mantles render any monopoly claims of the electrical industries quite unjustifiable.

9.—Electricity is an efficient and convenient means of transmitting power, and producing light. It is indispensable for electric railways, for transmitting power within works. It is required for many high-temperature electro-chemical processes, and for all electrolytic processes; so that it fills an increasingly important field.

It is an error, however, to suppose that electricity can economically displace gas for heat, light, and power.

The final paragraph of the report reads: "The foregoing discussion is strictly confined to relative claims of gas and electricity on the basis of heat economy. There are, however, many other important considerations which cannot be neglected if a just estimate is to be gained of the part which gas plays in the whole national economy. With a view to affording some information on these points, an appendix is attached, which has been prepared by Prof. Cobb, and reviews the position of gas, not only from the thermal standpoint, but in relation to such important questions as its substitution for solid fuel, and the utilization of the bye-products of its manufacture."

## The Appendix.

The appendix is comprised of "Notes on the Gas Industry," by Prof. Cobb; these notes dealing with the thermal analysis of carbonization, fuel consumption of electrical power generation, gas, electricity, and coal as heating agents, open fireplaces, gas traction, industrial heating, the material results of carbonization, coke, tar, tests on the carbonization of cannel by the Mineral Oil Production Department, benzol, ammonia, cyanogen, sulphur, and coal conservation.

## SIXTY YEARS AGO.

**[From the "Journal" for April, 1859.]**

**Regulating Measures for Sales of Gas.**—The Bill just introduced into the House of Lords by Lord Redesdale, "for regulating measures used in sales of gas," cuts the Gordian knot in which the subject has been entangled by the somewhat unseemly zeal of rival meter manufacturers and their friends. The uncertainty that now exists in the registration and construction of meters has long been an irritating source of complaint; and it seems strange that on the passing of the Act 5 and 6 William IV., for establishing uniformity of measures of capacity and for stamping them, the measurement of gas should have been altogether omitted. The principal object of Lord Redesdale's Bill is to supply this omission, and to determine the cubic foot of gas to be equal to a measure containing 62·321 lbs. of distilled water weighed in air at the temperature of 62° of Fahrenheit's thermometer, the barometer being at 30 in.

**Metropolis Gas Inquiry.**—We cannot allow the curtain to drop on the serio-comic, semi-tragic, and eminently absurd performances which, under the title of the Metropolis Gas Inquiry, have been recently performed at the Theatre Royal, Westminster, without a few additional passing notes and comments. The principal performers had evidently for some time been acting *contre-cœur*, and disliked the ridiculous position in which they were placed, of pretending to investigate a grievance, and of providing a remedy, after the grievance-mongers themselves had admitted there was nothing to complain of. The notion of throwing the responsibility of conducting the investigation upon paid counsel was an ingenious device to extricate themselves from the difficulty; and under the circumstances of the case it seemed to resemble the gratuitous advice given by the benevolent physician in "Punch," who recommended his pauper and somewhat troublesome patient to go to Baden Baden. As an effectual relief from their troubles respecting the Metropolitan Gas Inquiry, there have come the prorogation and dissolution; and in the fulness of time the "Comedy of Errors" will be completed by the publication of a ponderous Blue-Book containing the crude undigested evidence.

## The Gas Sales Department.

Regret was expressed by Mr. J. P. Hanlan, of the Public Service Gas Company, Newark (N. J.), in a paper which he read before the American Gas Association on "Gas Sales Policies," that, though the past year offered gas companies in the United States the best opportunity they had ever had to permanently increase the gas sales to the large percentage of their customers represented by skilled and unskilled labourers, factory workers, mechanics, &c., advantage could not be taken of the greatly increased purchasing power of this class, owing to the curtailment of the trained sales forces of the undertakings. They therefore not only lost the increased revenue from gas sales, but also the profits which could have been made from the sale of the appliances themselves. Next to food and clothes, no other single commodity is, to his mind, more necessary than gas for the comfort of this class of customers. They should use twice as much as they now do; but the only way this additional gas can be sold to them is by placing in the homes the right gas-range, gas water-heater, gas-iron, &c. To do this at the present prices of gas appliances requires real sales ability. Once this fundamental is understood by those whose money is invested in gas properties, and by others responsible for the management and future prosperity of these undertakings, the sales department will be considered just as essential to the gas business as the other departments are. The future prosperity of the gas industry depends entirely upon the ability of gas managers to sell gas at a profit in competition with other commodities furnishing similar services. It is no longer necessary, in order to do this, to sell gas appliances or do other jobbing work for consumers at a loss; and it therefore becomes a duty of the industry as a whole to adopt methods that will not permit such losses.

**The Hunter Gas-Burner for Boilers.**—There has been described and illustrated in the "Iron and Coal Trades Review" a new gas-burner for firing boilers, hot-blast stoves, &c., which has been patented by Mr. T. M. Hunter, of the Power Gas Company, No. 50, Wellington Street, Glasgow. Like many burners used for firing, it is designed to act on the principle of an injector drawing in and mixing with the gas the primary air. The air-inlet valves are in the form of rollers with longitudinal slots. By rotating the rollers in bearings formed in the body of the burner, a greater or less area of the slots is uncovered, and thus the supply of air entering is controlled. The valves are balanced so that they stay in any position required without the need of set-screws. This form of burner is specially suitable for blast-furnace gas under the conditions found at most plants. The weight of air drawn in as primary air varies almost exactly in proportion to the weight of gas passing, over considerable variations of gas pressure; so that the burner is self-regulating to a great extent. Air and gas are mixed in the body of the burner after the manner of a bunsen burner; but no trouble is caused by the back-firing when the pressure drops. As soon as the gas pressure returns, the flame is forced out of the burner, and burns once more without any attention from the attendant.

## THE NEW MANAGER OF THE NATIONAL GAS COUNCIL.

**Some Notes as to Mr. Fottrell's Career.**

In last week's issue [p. 193], we announced the appointment of Mr. Edward J. Fottrell, B.Sc., Assoc.M.Inst.C.E., to the position of Manager of the National Gas Council. In view of the prominence and importance of the office he now holds, the following notes regarding Mr. Fottrell's career will prove of interest:

Mr. Fottrell is an Irishman, and 34 years of age. He was educated at Downside and Leeds University, where he took the degree of Bachelor of Science. He had previously served his time in the locomotive shops of the Dublin and South-Western Railway, and had spent a year in the works of the Alliance and Dublin Consumers' Gas Company, under Mr. W. F. Cotton, jun., M.Inst.C.E.

After obtaining his degree, he was engaged during one winter on the preliminary survey of the Grand Trunk Pacific Railway in North-West Canada, but returned to the gas industry the following year, upon receiving an invitation from Mr. H. E. Jones to join the staff of his Westminster office. There, during four years, Mr. Fottrell gained his main experience of gas engineering in its many ramifications, including the promotion of Gas Bills in Parliament and arbitration proceedings in connection with the compulsory acquisition of privately-owned gas undertakings, together with the many problems of policy and construction which arise out of the control of a large number of gas-works both great and small. During this time he was elected an Associate Member of the Institution of Civil Engineers.

Shortly after the amalgamation of the Wandsworth, Mitcham, and Epsom Gas Companies, Mr. Fottrell was appointed Distribution Superintendent of the reconstructed Company.

Upon the formation in the early part of the war, of the Metropolitan Munitions Committee, Mr. Fottrell's services were lent to the Committee, by whom he was appointed Assistant Manager for South-West London, to organize the small machine-shops for the production of shells and shell components, pending the completion of the national factories.

When the activities of the gas companies (so far as the distribution of gas was concerned) were restricted by war conditions, Mr. Fottrell was given a commission in the Royal Engineers, and was stationed at Richborough, the port which was built by the Inland Waterways and Docks Department as one of the termini of the Channel train ferry. Subsequently, he was ordered to the War Office where, for about twelve months, he was attached to the mechanical engineering staff, and was engaged in the purchase of locomotives, cranes, and other mechanical equipment for the various overseas directorates of the Inland Waterways and Docks Department.

When the supply of ammonia became precarious, owing to the increasing demands for ammonium nitrate for amatol, and the simultaneous demand for large quantities of sulphate of ammonia for agricultural purposes, the Department of Explosives Supply applied to the War Office for the loan of Mr. Fottrell's services. Since the beginning of 1918, he has been acting, together with Mr. D. V. Hollingworth, F.I.C., F.C.S., the President of the Coke-Oven Managers' Association, as Technical Adviser on Ammonia Conservation, under the Director of Acid Supplies. In this capacity he has maintained his connection with the gas industry—the largest producers of ammonia in the country, with the exception of the coke-ovens. The recovery and sale of crude ammoniacal liquor at the small gas-works, which Mr. Fottrell endeavoured to encourage as a war measure, is, in his opinion, a possible source of revenue to these undertakings in the years to come.

## THE NATIONAL GAS COUNCIL.

**Meeting of the Central Executive Board.**

A Meeting of the Central Executive Board was held on April 15, when the Chairman (Mr. D. Milne Watson) submitted the report of the Sub-Committee on Management. As a result, it was decided to appoint as Manager to the Council Mr. E. J. Fottrell, B.Sc., Assoc.M.Inst.C.E. Mr. W. J. Smith was authorized to continue as Acting-Secretary.

Consideration of a motion put down by Mr. R. G. Clarry, with regard to obtaining parliamentary powers and securing greater unity of action throughout the industry, was postponed until the next meeting.

Resolutions from various District Institutions and Associations of Gas Engineers, District Executive Boards, and others, urging the importance of securing further financial relief, were reported and considered. Forms for obtaining statistics from gas undertakings on the matter were approved, and it was decided to send them to every gas undertaking in the kingdom at an early date.

It was reported that the division of the Midland District is not desired, subject to certain conditions.

It was reported that evidence had been given before the Royal Commission on Decimal Coinage with reference to the difficulty

which the adoption of the decimal system would create in the gas industry, particularly with regard to automatic supplies.

It was decided to ask a member of the Board to consider and report with regard to the import and export lists submitted by the Statistical Department of the Board of Trade.

The question of recommending the industry to adopt uniform arrangements with regard to Peace holidays was postponed pending further information of the Government's intentions.

The Board decided to approach the Coal Mines Department as to the date of the termination of the Household Fuel and Lighting Order.

An appeal from the Minister of Labour, urging the desirability of the employment of disabled ex-service men, was reported.

It was reported that the Council had communicated with several Members of Parliament in regard to the Bill to establish a Ministry of Ways and Communications, and that Sir William Pearce (a member of the Parliamentary Committee) had put down an amendment to Clause III., as follows:

Add and insert:

Provided always that any authority, body, or person claiming that any direction of the Minister is unreasonable or constitutes an undue preference, may complain to the Railway and Canal Commission.

If the Railway and Canal Commission determine that any such direction is unreasonable or constitutes an undue preference, such direction shall cease to have any force or effect.

A memorandum on the Report on Gas Constituents submitted by the Fuel Research Board to the Board of Trade was discussed and amended, and is to be presented to the Board of Trade.

In reply to the Council's request that the industry should be accorded the allowance made by the Coal Mines Department to local authorities in respect of seaborne coal re-sold to merchants at railborne price, the Controller had replied that this practice had been discontinued, and was only adopted to meet a special emergency now past.

The following were appointed a Finance Committee to the Council:

| | |
|---|---|
| Mr. R. B. Anderson, | Alderman Wm. Kay, |
| ,, A. E. Broadberry, | Mr. D. Milne Watson. |
| ,, Wm. Cash, | ,, F. W. Goodenough, |
| ,, A. A. Johnston. | ,, W. E. Price. |

It was decided to divide the present "Southern District" into two portions, to be called respectively the "Southern District" and the "London District," each of which should appoint four members to the Central Executive Board. Undertakings are to elect in which area they shall be included, subject to the approval of the Council.

## INSTITUTION OF GAS ENGINEERS.

### Council Meeting Minutes.

A MEETING of the Council was held at the offices of the Institution on Thursday last—the PRESIDENT (Mr. Samuel Glover) in the chair.

With reference to the examinations of the City and Guilds of London Institute, it was reported that Mr. Samuel Glover, the Examiner in "Gas Engineering," and Mr. Walter Hole, the Examiner in "Gas Supply" had, at the request of the Institute, consented to continue as Examiners until 1920, although their term of office would expire this year; and that Mr. H. Kendrick had been appointed to succeed Mr. R. Halkett, as Examiner in "Gas-Fitting." Questions arising from the reorganization of the Examinations, and suggestions of a scheme submitted by the Joint Council of Junior Gas Associations, were referred to a Committee for consideration and report.

The deaths of the following members were announced, and the sympathy of the Council was expressed with those who had been bereaved: Alderman Thomas Canning, of Newport (Mon.); Mr. W. J. Carpenter, of Great Yarmouth; Mr. Andrew Dougall, of Tunbridge Wells; Major Douglas F. Colson, D.S.O., R.E.; Mr. T. O. Paterson, of Birkenhead; and Mr. John B. Scott, of Cowdenbeath.

Applications for membership were considered, and the following were approved as candidates for the next ballot: For the class of Member: Mr. Ernest Ablett, Swansea; Mr. Arthur F. Ames, Padiham; Mr. Ambrose Barrett, Frome; Mr. Frank Boardman, Cardiff; Mr. Arthur J. Bond, Aberavon; Mr. Frederick Bowen, M.Sc., Leigh, Lancs.; Mr. Arthur J. Goats, Biggleswade; Mr. Francis R. G. Grant, St. Ives, Cornwall; Mr. Herbert A. Hunt, Crediton; Mr. Donald M. Macintyre, Montrose; Mr. Mark Newsome, Chorley; Mr. Harold M. Royle, Kensal Green works of the Gas Light and Coke Company; Mr. Alfred E. Ruffhead, Darlington; Mr. Harold Charles Smith, Swan Village Gas-Works, Birmingham; Mr. Edward G. Stewart, Fulham works of the Gas Light and Coke Company; Mr. George F. Twigg, Castleford; Mr. William Arthur White, Dawsholm Gas-Works, Glasgow. For the class of Associate Member: Mr. James Kenneth Westworth, Chemist and Assistant on the Coal-Test Works of the Birmingham Corporation. The following were transferred from the class of Associate Member to Member: Mr. Francis W. J. Belton, Macclesfield; Mr. William A. Twine, Superintendent of the Chemical Plant of the Birmingham Corporation; Mr. Sidney E. Whitehead, B.Sc., Portsmouth.

It was resolved that the Institution should become a constituent body of the Federal Council for Pure and Applied Chemistry —"to Advance, Safeguard, and Voice the Interests of Chemical Science." Dr. Harold G. Colman was nominated as representative.

The President-elect, with Mr. W. Chaney, and Mr. John Foster were appointed to represent the Institution at the James Watt Centenary Celebrations which it is proposed shall be held in Birmingham.

The following were reported as having been appointed District Members of Council for the year 1919-20: Mr. H. R. Wimhurst, Eastern Counties Association; Mr. G. S. Frith, Manchester District Institution; Mr. A. T. Harris, Midland Association; Mr. Norman S. Cox, North of England Association; Mr. Frank Livesey, Southern District Association.

The recommendation was approved that Mr. Thomas Hanby (B.Sc., First-class Honours) be appointed to the Institution Gas Research Fellowship at the Leeds University; and that the amount payable for the year be increased from £100 to £200.

A statement was received from Prof. Cobb indicating the nature of the work which is now in progress for the Gas Investigation Committee. The results of the work carried out since the last report, including that at Uddingston, were being completed for presentation. The research staff now consists of Mr. James W. Wood and Dr. A. Parker as Research Chemists, and Mr. H. Kerr and Mr. F. S. Townsend as Research Assistants.

The programme of the annual general meeting to be held in London on the 27th, 28th, and 29th of May was approved.

A report to the President of the Institution on Coal Conservation and the Coal Gas and Electrical Supply Industries of the United Kingdom, by Sir Dugald Clerk, K.B.E., Prof. Arthur Smithells, C.M.G., and Prof. John W. Cobb, C.B.E., was presented and adopted. The Secretary was instructed to forward the report to the National Gas Council, in order that it may be placed (with any supplement) before the Government and the Ministry of Reconstruction, as representing the considered views of all sections of the gas industry.

The report of the Demobilization Committee, of which Mr. R. G. Shadbolt has acted as Chairman from its formation, was presented, accepted, and adopted.

The Gas-Meter Research Committee reported progress of work on the internal corrosion of mains and services, and with reference to the proposed new standard sizes of dry meters.

A report was received from the Refractory Materials Research Committee on the work now in hand at Stoke-on-Trent. Communications relating thereto would be presented at the forthcoming annual meeting.

The report of the Finance Committee was presented, accepted, and adopted.

Mr. D. H. Helps, the Institution's representative on the British Association Fuel Economy Committee, reported that the work of the Committee, which had been suspended for some time, had been resuscitated. Arrangements for the future were referred to.

## Super Gas-Works v. Super Electricity-Works.

Writing in the current issue of the "Engineer," a correspondent signing himself "M. B. L." says: In view of the interest taken in the proposals at present before the country, that energy should be produced in bulk, it would be interesting to have the views of your readers on the relative merits of large electricity stations and equally large gas stations, both situated as near the pit-head as possible. Engineers recognize the advantages of electricity as motive and lighting power. But what about heating; and what of transmission difficulties? Would gas produced at the pit-head and distributed through pipes under pressure not be a more economical method? Of course, it would be necessary to strip the gas thoroughly, and deliver it as a mixture of fixed gases. But that would only increase the bye-products. To the gas got by distillation would be added that produced from coke, and the combined gases sold on a heat basis. Gas would replace coal on every domestic grate and in every commercial furnace. Instead of trains of coal trucks, which return empty, gas would flow through the mains. For lighting and power purposes it would be transformed into electricity, if required, either by gas-engines if the amount required were small, or by a steam-turbine plant if the power were large enough—the boilers being gas-fired. In this, surface combustion might play a large part. Every bye-product would be salved; and by regenerative processes heat used in production would be reduced to a minimum. This letter is inspired to a certain extent by Sir Dugald Clerk's address before the Royal Society of Arts; but the matter has been in the writer's mind for some time. Large central gas stations seem obvious as a measure of economy both as regards first cost and working; but they have never, in so far as the writer can remember, received the advocacy of the Engineering Press. There must be good reasons for this. What are they?

**Temporary Increase of Charges Act.**—The Local Government Board have made an Order under the Statutory Undertakings (Temporary Increase of Charges) Act, by which the Borough of Stoke-on-Trent are authorized to raise their charges within the limits of supply under the Longton Acts from 3s. 6d. and 4s., and under the Burslem Act from 4s., to a maximum in both cases of 5s. per 1000 c.ft.

# GAS STANDARDS.

## THE REPORT AND RECOMMENDATIONS OF THE FUEL RESEARCH BOARD.

In a letter dated June 26, 1917, the Fuel Research Board were asked by the Board of Trade and other Departments concerned to advise as to "What is the most suitable composition and quality of gas and the minimum pressure at which it should be generally supplied, having regard to the desirability of economy in the use of coal, the adequate recovery of bye-products, and the purposes for which gas is now used." The Fuel Research Board, with the approval of the Committee of the Privy Council for Scientific and Industrial Research, having made the necessary investigations and inquiries, have, under date of Jan. 29 last, reported as follows to the President of the Board of Trade (the Right Hon. Sir Albert H. Stanley, M.P.). The signatures to the report are those of Sir George Beilby, Sir Charles A. Parsons, Sir R. A. S. Redmayne, and Sir Richard Threlfall.

Following the lines of the reference to us, we have carefully considered the various interests which may be affected by any change in the present standard. The most direct of these are the interests of the consumers and producers, which coincide at some points, while at others they are divergent.

There are, in addition, other interests of wider and national importance, as, for instance, the conservation of the coal resources of the country and their utilization for the provision of cheap and ample supplies of energy for heating, lighting, and power production in centres of population and industry.

The gas industry uses from 18 to 20 million tons of coal per annum, or approximately one-tenth of the total home consumption. It is therefore, the most important existing organization for the distribution of potential heat-energy; while it shares with the electrical undertakings in the distribution of energy for the production of light and power.

For the consumers, it is of the first importance that they should be served with a cheap and ample supply of gas suitable for heating, lighting, and power purposes on a basis of cost the fairness of which they can readily understand and accept.

For the producers, it is important that they should be as free as possible to develop those methods of production which will yield the largest and most economical output of potential heat-energy in the form of gas from the coal they use.

The national interests will best be served by that policy which will promote the widest adoption of scientific methods for the preparation and use of fuel.

### Present System of Standards Unsatisfactory.

The more closely the present system of standards is examined, the less satisfactory does it appear from any of the above points of view.

It would be idle to pretend that consumers generally are satisfied with the results of the alterations in standards which had begun to come into operation before the war; and the advent of war conditions tended to aggravate this dissatisfaction.

It is also admitted by those who are informed on the subject that the war conditions placed the producers of gas in a position of the gravest difficulty. The hardships which resulted have, therefore, been shared alike by producers and consumers.

These experiences have carried lessons both for consumers and producers which it is hoped will more than compensate in the future for the troubles of the past.

Those who represent the interests of consumers are now in possession of actual experience of the effects on these interests of considerable and uncertain changes in the quality and composition of the gas supply. They are, therefore, in a better position to safeguard these interests more securely for the future. They have, in addition, had forced on their attention, as never before, the need for a more real co-operation between consumers and producers, if the best results are to be obtained in the common interest.

The producers are already keenly alive to the lessons of the past four years; and their anxiety to profit by these is quite natural, and ought to be encouraged in every legitimate way.

### Co-operation and Economy.

We are hopeful that producers, as well as consumers, will realize the value of the present opportunity for the establishment of more effective co operation; and in arriving at the proposals we have to make, we have had this ideal always before us.

The need for increased economy in the use of coal has been forced on the notice of the community as a whole by the serious shortage of supplies; while the work of the Coal Controller has shown the need for a co-ordinated system of distribution which will ensure that the coals from each centre of production will be used as closely as possible to these centres.

In the interests of national economy, it is most important that the gas undertakings should be in a position to select those coals which can be drawn from the nearest centres of production. A comparison of the prices of gas in the country at large shows the important part which proximity to the centres of coal supply can play in gas production.

The needs of the Explosives Department have stimulated the adoption of "stripping" for the production of benzol and other hydrocarbons; and the gas undertakings are now alive to the importance of these hydrocarbons as bye-products, the sale of which may help to reduce the cost of the primary gas supply. The future of these bye-products will, it is to be hoped, no longer depend on their use for the manufacture of explosives on the scale of the past four years; but their use as motor spirit is likely to extend and to increase, and will provide an outlet for all that is not required by the synthetic chemical industry. It is common knowledge that this industry is based on the hydrocarbons of the benzol group.

The need for a greatly increased output of metallurgical coke, and the consequent development of carbonization in recovery ovens, is likely to bring into prominence the absorption of the resulting gas into the distributing systems of gas undertakings. Here, also, the question of the proximity of the centres of production (the coke-ovens) is of first importance. No more than a passing reference to this subject can be made in this report; but it has a real significance when the need for elasticity in the fixing of gas standards has to be considered.

We have followed with close attention the views and opinions on gas standards which have found expression in the Technical Press and elsewhere during the past year. As might have been expected, some of these views are extreme and unpractical; but for the most part the impression is conveyed that the technical leaders in the industry are mainly desirous that they should be given freedom to carry out any or every development in the carbonization and gasification of coal which will lead to economy of production. The prevailing view appears to be that the elasticity in manufacture which they desire can best be secured by the fixing of a sufficiently low calorific standard.

We consider, however, that the fixing of a uniform low standard might be as great a danger to the development of the industry as the fixing of a uniform high standard would be; for the one from certain aspects would be practically as inelastic as the other. We are convinced that the desired elasticity is not to be obtained in this direction, but rather by so safeguarding the interests of the consumers that each gas undertaking may be given freedom of choice as regards raw materials, processes of manufacture, and quality of gas, so that it may be in a position to meet the needs of the locality most satisfactorily. For each centre of population and industry has its special conditions and environment, which ought to be considered—its distance from the sources of coal, the types of coal which are available, and the outlets which exist for the principal product and its bye-products.

### A Charge for Thermal Units.

We believe that the interests of the consumers can best be conserved if their contract with the gas undertaking is based on the sale and purchase of heat energy measured in fixed units which can be scientifically determined by simple means. We propose, therefore, that the consumer should be charged for the thermal units which he actually receives, in the same way as the consumer of electricity is charged for the Board of Trade units which pass through his meter.

The thermal units so charged would be calculated on the volume of gas delivered at a calorific value based on the standard adopted by the gas undertaking itself. Thus:

1000 c.ft. of gas of 500 B.Th.U. standard would be charged as 500,000 thermal units. With a gas of this quality selling at 50 pence per 1000 c.ft., the equivalent price under the new system would be:

1 penny per 10,000 B.Th.U.
10 pence per 100,000 B.Th.U.
100 pence per 1,000,000 B.Th.U.

The gas-meter would thus continue to be the measuring instrument as between consumer and producer; and the conversion of cubic feet into thermal units would be easily and accurately made by the use of conversion tables.

The exact relation which the calorific standard to be used in this calculation should bear to the gross calorific value as determined by the gas-calorimeter must be carefully considered.

The almost theoretical efficiency of the gas calorimeter is attained, because it utilizes heat of all grades from a temperature difference of many hundred degrees to a difference of at most a few degrees above the temperature of the cooling water.

Few, if any, of the gas appliances in ordinary use can be adapted to use the lower grades of heat. The nearest approach to the gas calorimeter in this respect is the flueless, radiating, condensing stove. In this stove, the whole of the heat of combustion of the gas is received in the room, and most of it is made available for warming the air, the walls, ceiling, floor, and the other bodies or objects in the room. Unfortunately, this high efficiency is gained

at the expense of the purity of the air, which becomes contaminated with the products of combustion.

### The "Availability" of Heat Developed.

While the total heat supplied in a given volume of gas is easily and accurately determined by the calorimeter, the "availability" of this heat depends on a rather complex set of conditions. In domestic heating and lighting appliances, not only the temperature of the flame, but also its volume and shape, influence the "availability" of the heat developed. The theoretical temperature of combustion of a given gas burning in air cannot, therefore, be taken as a measure of the "availability" of the heat developed by the gas in any given type of apparatus. In other words, the "availability" from the consumers' point of view depends, not only on the theoretical potentialities of the gas, but very largely on the use of these potentialities in the particular apparatus in which it is consumed.

### Adjustment of Appliances.

The system of charging by thermal units would be simplified by regarding the value of the units of all gases as strictly on a parity—if, for example, the relative values to the consumer of gases of 500 and 400 B.Th.U. could be taken as exactly in that ratio. But the experimental proof of this parity is still incomplete; and all that can be said at present is that, if the consumers' appliances are properly adjusted for the correct use of the grade of gas with which they are supplied, this parity may be tentatively accepted.

The adjustment of consumers' burners and other appliances for the most efficient use of the gas supplied is, therefore, of fundamental importance, if the producer is to be granted the freedom we propose should be given him.

From evidence supplied to us, we are satisfied that the effects of the unsatisfactory nature of the gas supply during the war have been greatly aggravated by the fact that the burners and other appliances in which it had to be burned were wholly unsuited for its safe and efficient consumption.

If the method of charging which we suggest is adopted, one of the safeguards to be provided in the interest of the consumers must be the placing on the producers full responsibility for the adjustment of, and if need be the replacement of the burners in, consumers' appliances with all reasonable speed when a change of standard is instituted.

### Gas Examiners and Inspectors.

It is of paramount importance that suitable machinery shall be devised by which the views of consumers shall be given adequate consideration, and their interests protected. In this connection, it may be suggested that every supply district above a certain magnitude ought to be provided with one or more gas examiners, and, if necessary, a staff of inspectors whose whole time should be devoted to looking after the interests of gas consumers. The smaller gas supply centres should be grouped into districts for these purposes. Any arrangement of local gas examiners and inspectors no doubt postulates central supervision and co-ordination.

In considering the complaints which have been brought before us by consumers, we have endeavoured to discriminate, as far as possible, between those due to war conditions and those which may fairly be attributed to the effects of normal working under the existing standards. There can be no doubt that the worst of the experiences complained of were greatly aggravated and brought into notice by war conditions.

### Twelve Per Cent. of Inert Gases.

The practice of "over-exhausting" at the retorts, which is responsible for the almost universal increase of inert gases, became a feasible expedient because of the relaxation of the candle-power standard prior to the war, and of the granting of permission, during the war, to reduce the calorific value to 450 B.Th.U. The temptation to use this opportunity to augment the yield of gas at the expense of its quality was no doubt strengthened during the war by the greater demands which had to be met from coal supplies inferior in quality and deficient in quantity.

It was to be expected that the consumers whose heating and lighting appliances were made and adjusted to burn gas of 500 B.Th.U. and over would be quite upset by a drop in standard to 450 B.Th.U or less, more especially as this drop was largely due to the abstraction of benzol and the addition of inert gases.

These war-time experiences emphasize the need for the protection of the consumer from arbitrary changes in the quality and calorific value of the gas supply for which he has not been fully prepared.

With regard to the dilution of coal gas by inert gases, many leading gas engineers have expressed their strong disapproval of the practice; and we are not aware that any engineer of standing would be prepared to defend it seriously. But the fact that it has been largely resorted to as an emergency measure during the war, in order that full advantage might be taken of the temporary reduction of the calorific standard to 450 B.Th.U. appears to us to be a strong argument against the present method of applying the calorific standard, and in favour of the method we propose.

Under the proposed method, there will still be a standard to which the gas undertaking must adhere. But a standard set by the gas undertaking itself, to suit its own conditions, and which, moreover, can, on due and sufficient notice, be altered from time to time, will be totally different in its effects from a permanent fixed standard adjusted to meet average conditions and stereotyped by legislation.

The natural diluent for coal gas is water gas, made either from coke in a separate producer or in the retorts by steaming the hot coke. Neither of these methods of dilution involves any serious addition of inert gases to the mixed gas; and from the opinion of experts, we are satisfied the imposition of a maximum limit of 12 p.c. of inert gases would in no way curtail the legitimate freedom of choice of raw materials and methods of production by the producers, while it would reassure those consumers who have suffered in the past from the excessive introduction of inert gases. It must be remembered, also, that the system of charging the consumer only for thermal units actually delivered will remove from the producers the inducement to dilute the gas supply by the addition of inert gases.

### Possibility of Dual Supply Systems.

As regards the composition of the combustible constituents of the gas, it appears to us that the system of charging which we propose will directly encourage the making of special arrangements between the producers and groups of large consumers for industrial purposes who wish to be supplied with gas of special qualities and composition. For some industrial purposes, water gas is an ideal gaseous fuel; for other purposes, a gas rich in methane or other hydrocarbons is best. The proposed system of charging will give the producers freedom either to modify the character of the general supply to meet the special industrial needs of the district or to deal with the situation by setting-up a dual supply system.

While it is admitted that any general duplication of mains and supply is quite out of the question at present, yet, in the type of cases referred to in the immediately preceding paragraph, it might be quite feasible to have special pipes delivering a different supply over a short radius from the gas-works.

We anticipate that the adoption by the gas undertakings of the system of charging only for thermal units of energy actually delivered to the consumer will greatly stimulate the industrial use of gas; and as any great extension of consumption must inevitably involve an increase in the capacity of the distributing mains and plant, the more general adoption of a dual supply system may not be so far off as many of us have supposed.

### Gases Available.

The gases available either for blending into one principal supply or for distribution for special purposes cover a fairly wide range of qualities. At the upper end of this range will stand the gas obtained by the carbonization of coal at 500° to 600° C. This gas is rich in methane, and has a calorific value of over 800 B.Th.U. It is peculiarly suitable for compression and transport in cylinders, for use either on railways or on motor vehicles.

Next in order are the gases resulting from carbonization at high temperatures in coke-ovens and gas-retorts, with calorific values between 500 and 600 B.Th.U.

Blue water gas follows, with a calorific value of 300 B.Th.U. This is one of the finest and most manageable of fuel gases for industrial purposes which it would pay, in certain cases, to distribute over a fairly wide area.

Last on the list comes producer gas of 130 to 140 B.Th.U., washed for the recovery of ammonia or for the removal of dust and tar. This gas may be the cheapest gaseous source of heat energy to produce; but it is the most expensive to distribute over a wide radius. Owing to its high percentage of inert gases, it is obviously quite unsuitable for the dilution of coal gas for general supply purposes. If this gas is produced in gas-works for purposes other than heating within the works, its distribution would have to be by means of a special system, and over a relatively short radius.

Each of these gases has its own characteristics; and there are probably purposes for which each is specially suited. It therefore appears to us that the continuance of the present system of standardization, which tends to the obliteration of these characteristics by a universal process of blending for the production of a gas to conform with a certain artificial standard, would be entirely contrary to the spirit of progress.

So long as the technical staff of the gas undertakings are compelled to narrow their outlook, and limit the exercise of their imagination, by the prime necessity of conforming to a stereotyped standard evolved to suit average conditions, and having no direct relation either to the needs or the resources of their own district, so long will they be compelled to lag behind in the industrial race.

The sheet-anchor of the gas industry in the future must necessarily be its possession of the cheapest known means of distributing potential heat energy in a convenient form. For lighting and for power production, the electric supply of the future may seriously contest the field with the producers of gas; but for the supply of heat, gaseous fuel ought to remain supreme, if its production and use are developed on sound lines.

### Conclusions.

We have indicated in the argument developed in the foregoing pages that we do not consider that it would be to the ultimate advantage of any of the interests concerned that any one fixed standard of composition and calorific value should be prescribed. The proposal of any such combined standard would lead to much discussion, which would probably result in some form of compromise being accepted which would not really meet the needs of

the situation. Further, the prescription of a standard of composition in addition to the present standard of calorific value would probably fetter the development of a good and cheap gas supply to an even greater extent than the present single standard is said to have done. The arguments already advanced on this point need not be repeated here.

We propose that a new system of charging should be adopted, instead of the present system. This may be summarized as follows:

1.—The consumer to be charged for the actual thermal units supplied to him in the gas passing through his meter.
2.—The thermal units chargeable to be calculated by multiplying the number of cubic feet registered on the meter by the calorific value per cubic foot.
3.—This calorific value to be based on the usual test in the gas calorimeter, subject to any modification which may be accepted in the mutual interest of consumers and producers, and sanctioned by the Board of Trade.
4.—Subject to the acceptance by the gas undertaking of the stipulations laid down in articles Nos. 1, 2, 3, 5, 6, and 7, the gas undertaking to be free to deliver to the consumer any mixture of ordinary combustible gases free from sulphuretted hydrogen, and not containing more than 12 p.ct. of inert constituents.
5.—The gas undertaking to declare the calorific value of the gas it intends to deliver, and to undertake to adjust consumers' appliances for the ordinary purposes of domestic lighting, heating, and cooking, so that the gas delivered can be burned in these appliances with safety and efficiency.
6.—Should the gas undertaking desire at any time to change the calorific value of the gas supply, due notice to be given to the consumers or to their representatives. During the period of notice, preparations to be made by the gas undertaking for any readjustment of the consumers' appliances which may be required to ensure safety and efficiency in the use of the new supply.
7.—The gas undertaking to supply gas at such a pressure that, under normal conditions of supply and equipment, there shall be a pressure of not less than 2 in. of water on the gas at the exit of the consumers' meters.

When more than one quality of gas is distributed to general consumers, the foregoing stipulations should apply to all the gas supplied.

When gas for industrial use only is supplied in bulk—to be used exclusively in furnaces, muffles, steam-boilers, water-heaters, gas-engines, or in burners of any kind from which the products of combustion are efficiently removed by flues or exhaust fans and discharged into the open air at a height of at least 10 ft. above the level of the adjoining roofs—some relaxation in the foregoing stipulations may be permitted.

With regard to sulphur purification, strong representations have been made to us on the desirability of the complete removal of sulphur compounds from gas. From our own experience in laboratories and workshops, as well as in houses where the bad effects of these and other impurities on apparatus and fittings are always in evidence, we were prepared to receive these representations sympathetically. We therefore strongly urge that the more complete removal, not only of the sulphur compounds, but also of the cyanogen compounds, should be kept well in view by all the interests concerned.

Though it is proposed that each gas undertaking shall be free to fix the calorific value which suits it best, the experience of the electrical industry in regard to lamps and voltages has shown that unlimited licence in this respect has resulted in the needless multiplication of lamps and fittings for odd voltages which have to be made and stocked. It seems desirable, therefore, that, before any legislation is undertaken, the representatives of consumers, producers, and makers of fittings and burners should jointly decide on the standardization of burners in appliances for a limited number of calorific values. It is suggested that four standards may be sufficient: 400, 433, 466, and 500. If these are regarded as minimum figures, the adjustment in each case should admit of an increased aëration to suit gases up to the next higher standard.

**Silica Refractories.**—The United States Bureau of Standards have published a paper dealing with the factors affecting the quality of silica refractories, their manufacture, and the method of testing the raw materials as well as the finished ware. Owing to the present large demand for silica refractories, the tendency is to burn them as rapidly as possible to a temperature about equivalent to that required to cause Orton's pyrometric Cone 18 to bend over. The experiments conducted in the Bureau's laboratory show that at temperatures from 1250° to 1350° C. there is a slight fluxing or drawing together of the particles of a raw brick; and that at these temperatures transformation of quartz to the forms of lower specific gravity takes place at a moderate rate. Thus, these temperatures ensure minimum porosity and a medium rate of transformation. At higher temperatures, however, the transformation takes place rapidly, causing the porosity of the brick to increase unduly. The heating tests with raw commercial bricks brought out the fact that mixtures made from the principal commercial quartzites all transform at about the same rate at a temperature from 1200° to 1500° C., and that the final specific gravities of all are very close together.

## PERSONAL.

We learn that Mr. W. G. Head has completed his work with the Ministry of Munitions, and has resumed his usual duties with the South Metropolitan Gas Company.

Readers will join in the congratulations which have been extended to Mr. Alexander Wilson, the Engineer and General Manager of the Glasgow Corporation Gas Department, on his recovery from the eye operation which he recently underwent.

The retirement is announced of Mr. T. O. Morland, who has been Engineer and Manager of the North Shore (Sydney) Gas Company for the past 35 years. He has accepted the position of Consulting Engineer to the Company.

Mr. Gordon M'Nair, who has been the Gas Manager at Dalbeattie for nearly four years, has been appointed to a similar position at Kirkcudbright.

M. Marie-Joseph Delaporte, the Manager of the Union Gazière Est-Nord-Nord-Ouest, has been made a Chevalier of the Legion of Honour, in recognition of his services during twenty-nine years of military and industrial life.

## OBITUARY.

### WILLIAM J. CARPENTER.

On Easter Monday, the death took place, at his residence in Princes Road, Great Yarmouth, of Mr. William John Carpenter, the Engineer, General Manager, and Secretary of the Great Yarmouth Gas Company. He had been ailing for some months.

Mr. Carpenter, who at the time of his death was 58 years old, was the son of the late Mr. W. T. Carpenter, who was for many years Engineer and Manager of the Sheerness Gas-Works. On leaving school, he joined his father at Sheerness in 1877, and served his apprenticeship as a gas and water engineer. Upon the completion of his indentures, he became Assistant to Mr. John West; and in 1887 he went to Yarmouth, as Gas-Works Manager. For many years Mr. R. P. Spice was Engineer of the Company; but on his death, Mr. Carpenter was appointed Engineer. In 1905, he was made General Manager of the Company, in addition to his position as Engineer. Then Mr. Charles Panchen, the Secretary (after 45 years of continuous service), retired in 1907; and Mr. Carpenter had the position of Secretary also conferred upon him.

Thus more than one-half of his life Mr. Carpenter spent in the service of the Great Yarmouth Gas Company; and this long period of thirty years' service led to the gratifying results in various directions which were to be expected from the thoroughness of his work. As to the development under his care of the business of the Great Yarmouth Gas Company, many interesting particulars were contained in a paper which he read before the Eastern Counties Gas Managers' Association ten years back [see "Journal," Vol. CVI., p. 216]. Of this Association, Mr. Carpenter was a valued member; and in 1894 he occupied the Presidential chair. His presence will be missed from the meetings of the Association, as it will be by very many other friends. He was an associate member of the Institution of Civil Engineers, and had rendered professional assistance in connection with the erection and extension of various gas-works in the district round about him. The companies and bodies to whom he acted as Consulting Engineer included the Sheppy Gas Company and the Yarmouth Board of Guardians, to whom he had given valuable advice.

Mr. Carpenter leaves four sons and one daughter. The eldest son is Engineer and Manager to the Beccles Water and Gas Company. Of the remaining three, one held during the war the rank of Major, and two have still the rank of Captain.

The "Journal des Usines à Gaz" is only now able to record the death of certain Continental gas men who had the misfortune to be located in places occupied by the Germans during the greater period of the war. One of these is M. Boscheron, the head of the Liege Gas Company, and a Past President of the Belgian Gas Association, who died in June, 1915. Another is M. Tabourin, the Proprietor of the gas-works of Neufchateau, in the Vosges, where he remained at his post until his death on Dec. 12 last year, through the bombardments and aerial raids which were frequent in this section of the Western front. A third is M. Willems, for forty-eight years in the Ghent Gas-Works and finally its Manager, who also died last year.

The Priority Department of the Ministry of Munitions was closed on the 16th inst. Any communications or inquiries which may arise as to priority should in future be addressed to the Secretary, Ministry of Munitions (Room No. 554), Hotel Metropole, London, W.C. 2.

The New York Public Service Commission, Second District, rules that a statutory maximum to be charged for gas "manufactured, furnished, or sold" in a specified city does not apply to gas manufactured therein and transmitted by means of pipes and sold to private consumers in neighbouring municipalities.

# THE NEW "EAGLE" GAS-RANGE.

## SUCCESSFUL REALIZATION OF HIGHER EFFICIENCIES.

It is perhaps an unconscious tribute to the thoroughness and the foresight of those manufacturers who originally pioneered the gas-cooker—now well over fifty years ago—that, in the intervening time, the inevitable changes and developments in detail construction have left the broad lines of design so little changed. But we live now in times when landmarks are being shifted; and on every side movements both drastic and swift are being made on the path of progress. Days they are, too, when the merely national is apt to be reckoned provincial, and the best ideas and practices of various peoples are welcomed to supplement and to blend with the time-honoured ways of home. Custom, it is felt—however long-established—has no prescriptive rights if innovation can be shown to be improvement, and if to the *vis inertiæ* that lies in the trouble and cost entailed by change is opposed the driving force that comes with the vision of the great things to be achieved when the old order shall have changed and given place to the new. It would be a hasty view to attribute this wholly or even chiefly to the war. The new spirit was in the air a good while before the year 1914; and, although the war has hastened many things, it has also hindered not a few.

### Breaking-Away from Past Traditions.

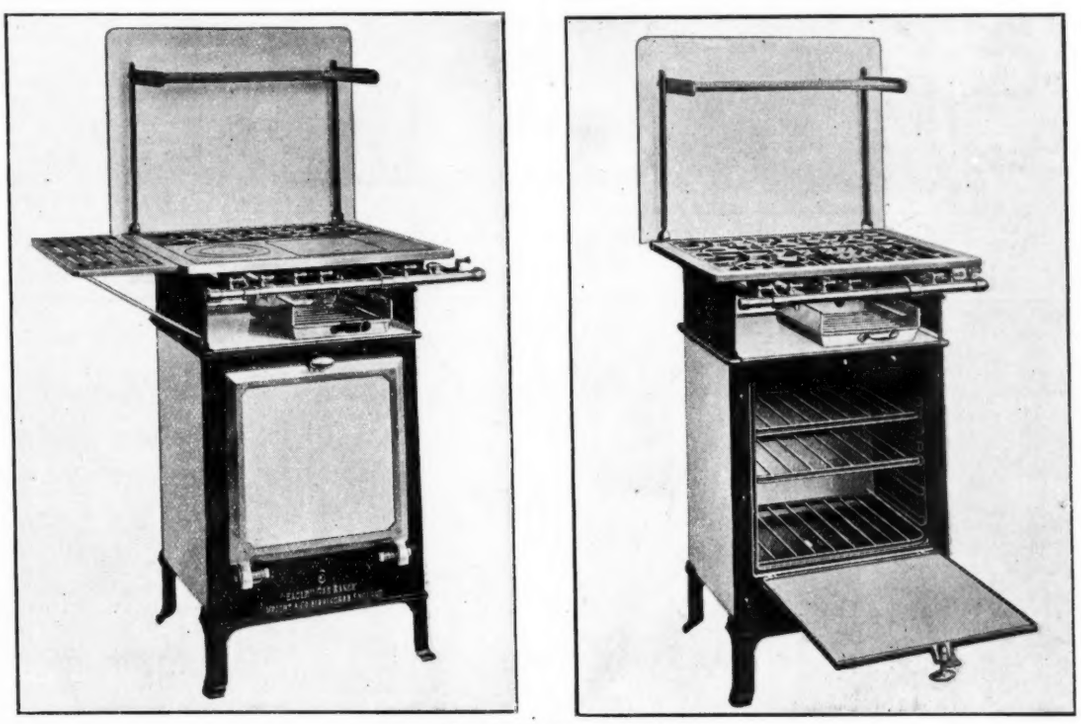
These observations fitly apply to the new type of gas-cooker—the "Eagle" gas-range—particulars of which are now for the first time made public. There are numerous makes of gas-cookers, and many varieties and sizes of each; but the "Eagle" gas-range does not range itself (if the unintended play on words may be pardoned) with any of these. Its designers have set-out to break with past traditions—not for any love of change, for none know better all that change involves—but in order to give to the gas industry and the public a new instrument suited to the needs of the new time. In deprecating any thought of change for change's sake, Messrs. John Wright & Co. are equally far from any idea of disparaging existing types of cookers which have done, and are doing, so wide and worthy a service.

### War-Time Delays.

Quite a long while before the fateful August days of 1914, Messrs. Wright & Co. had been working on the new idea, endeavouring by continuous experimenting to arrive at a new type of cooker fitted to give efficiencies altogether higher than those of the existing normal type. As so often happens in such circumstances, their work was slow to yield a sufficiently increased standard of efficiencies and general utility to warrant their issuing a challenge to the existing order of things by placing a new kind of cooker on the market. At length (early in 1914), their efforts were rewarded by a new type being arrived at, which, in their judgment, clearly marked-out a fresh future for cooking by gas. War retarded their work of finally constructing the new type in such complete form as could be offered to the public. The work was, however, continued as opportunity offered; and during 1918 the firm completed a gas cooker which shows unprecedented economies and efficiencies, together with a number of other novel and conspicuous advantages. Patterns and plant were gradually prepared in the latter part of that year—experimental stoves being meanwhile kept under continuous test and observation in use under different conditions; and in January this year a specimen of the new type of cooker in its perfected form was ready for a private view.

### Gas Economy the Objective.

The accompanying illustrations show such divergence in outward appearance from hitherto familiar types as to prepare the mind for the equally great changes in design, in working parts, and in methods. The ruling purpose has been to effect fresh and substantial economies in gas—not by mere tinkering with existing forms of construction, but by replacing these with forms conceived on radically different lines—it being recognized that mere fractional increases in gas saving would be useless to achieve the widely extended domestic use of gas aimed at. Other changes making for health, labour-saving, increased utility, and decrease in cost of maintenance, have been treated on a similar large scale, as it has been felt all conduce towards the same ultimate end.



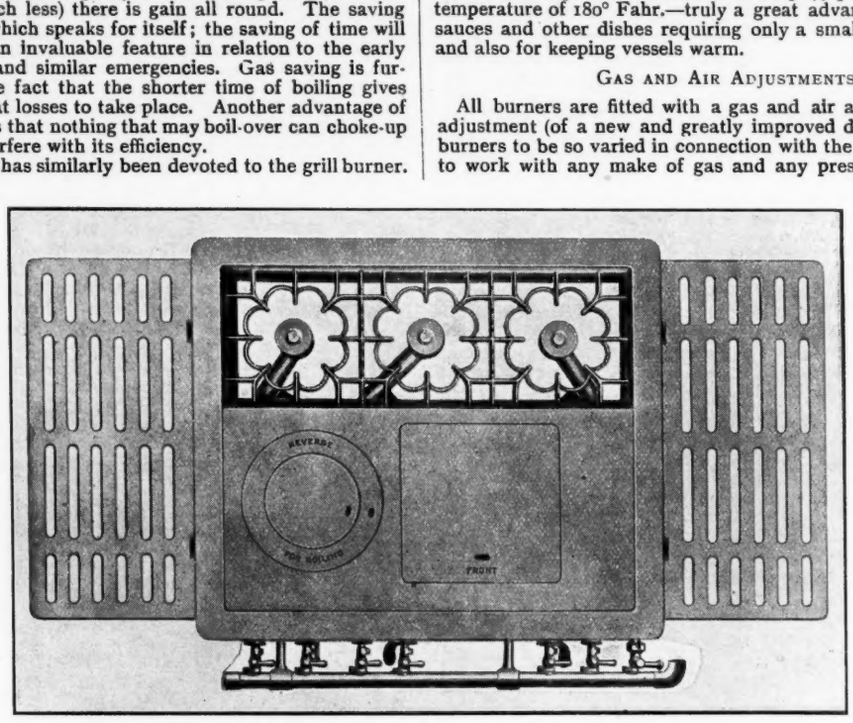
THE NEW "EAGLE" GAS-RANGE.

### Raising Efficiency on the Top Plate.

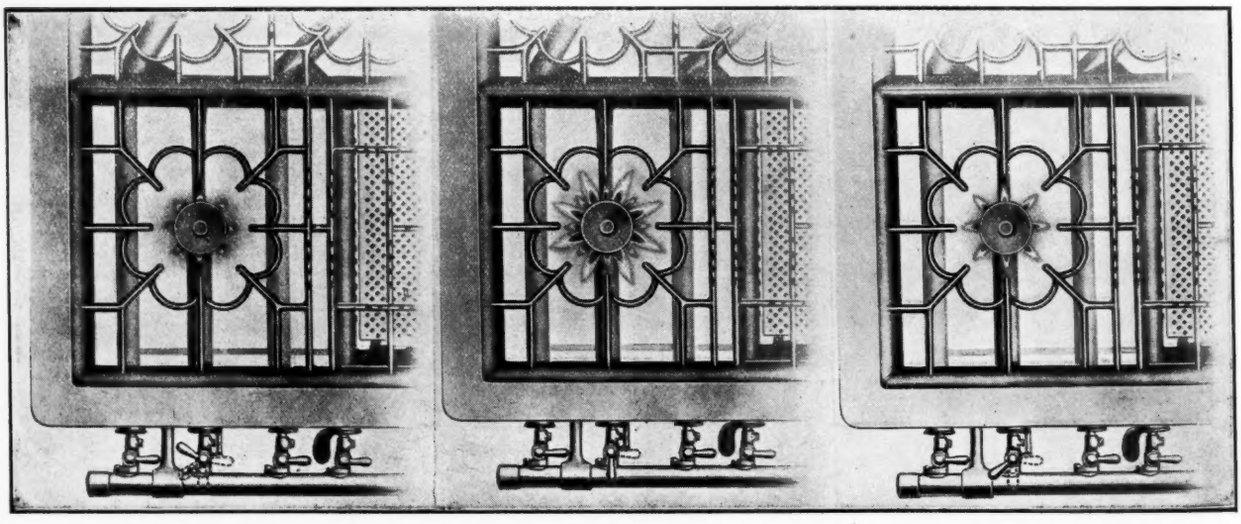
One of the earliest problems to be tackled in the planning of this new type was that of the boiling-burner and the top-fret or utensil-support; it being recognized by the designers that efficiencies in this part of gas-cooker duty had not nearly reached the point to which they should and could be brought. The result was the construction of a burner differing from its predecessors as radically in efficiency as in appearance. Not only is the burner novel, but the top-fret leaves the conventional lines altogether. Its design (which has been protected), though pleasing to the eye, was not produced for any such purpose, but is the result of prolonged experiment, with a view to ensuring that every possible heat unit from the flame is allowed to concentrate on the vessel, instead of much of it being absorbed by the top fret or top bars, and thus wasted so far as useful duty is concerned. The semi-circular curves receding from the centre are so spaced in alternation with the projecting points for carrying the vessel that the jets of flame from the burner enter the middle of each curve and miss the projecting points, and concentrate on the under-side of the vessel; while by the same means there is ample space for due ventilation of the flame either with large vessels or with small. The burner is purposely reduced in size; and yet it has a greater consumption-capacity available if desired than the existing types—the object being to concentrate short and intense flames on the

bottom of the utensil, instead of letting the flames spread over the edges and up the sides, which occasions great heat loss with the present type of boiling burner. Apart from the saving thus effected, this perfectly-constructed burner applies the heat to the utensil only where it is wanted, and a large amount of heat in a short time, which means great rapidity in the boiling and (the time occupied being much less) there is gain all round. The saving of gas is a virtue which speaks for itself; the saving of time will be recognized as an invaluable feature in relation to the early morning breakfast and similar emergencies. Gas saving is further effected by the fact that the shorter time of boiling gives shorter time for heat losses to take place. Another advantage of the burner design is that nothing that may boil-over can choke-up the burner and interfere with its efficiency.

Special attention has similarly been devoted to the grill burner.




COMPLETE HOT-PLATE, WITH RIGHT AND LEFT HAND EXTENSIONS.



Gas at Minimum Point. Gas Full-On. Gas at "Simmering Height."

THE DUPLEX BURNER EMPLOYED.

The size and efficiency and equal heating of the grill have been improved in a marked degree. A notable advantage is that the grill burner, when used in the boiling position, is truly efficient as no grilling burner has ever been before, and hence the substantial economy which results.

### A Useful Tap Lever.

An interesting feature is the contrivance by which the movement of the tap-lever gives in succession full flame and a flame reduced to "simmering" proportions. The latter is reached by simply pushing the lever further round from the full-flame position until it comes against a stop. And, in practice, this effects a further distinct saving in gas. For simmering purposes, the gas is so conveniently turned down, and always to the lowest adequate flame.

### Duplex Boiling Burners.

Some of the boiling burners in the hotplate are constructed in the duplex form, although the overall size of the burner is no greater. One tap when full-on works both parts of the duplex burner; and when the lever is pushed half-way round, the large burner is turned-out and the simmering burner remains on. By further pushing the lever round to the stop, the simmering burner is reduced to a consumption of only 1¼ c.ft. per hour; and it has been found in practice that this will keep 4½ pints of water at a temperature of 180° Fahr.—truly a great advantage in preparing sauces and other dishes requiring only a small amount of heat, and also for keeping vessels warm.

### Gas and Air Adjustments.

All burners are fitted with a gas and air adjuster. The gas adjustment (of a new and greatly improved design) enables the burners to be so varied in connection with the air adjustment as to work with any make of gas and any pressure that is likely to be supplied in this country, or indeed any other. Tests have been made on the cooker with gas as low in calorific value as 350 B.Th.U., and as high as 600 B.Th.U.—and with equally satisfactory results.

### Hot Plate Extension Pieces.

Although the hot plates are of ample size, yet provision has been made by which an extension-piece can be attached on either side, or both. These are easily fitted on where space permits; and their advantage is that utensils can be placed upon them when not in use.

### Solid Hot Plates—if Desired.

Striking by its novelty among the types of gas cooker in use in this country, is the provision made in the "Eagle" gas-range for having, if desired, wholly or partly "solid" hot plates. "Solid" hot plates have long had their advocates, because it was thought that if a plate could be heated-up with one burner a large number of utensils might be heated at the same time with less gas. This

has been proved to be a mistake. A little reflection shows that it is impossible to cover every part of the hot plate with utensils; therefore all parts that are not so covered form heat-losing surfaces. Apart from this, the plate which fits into the frame of the hot plate conveys heat to the body of the cooker; and there is, therefore, further heat lost by conduction. In constructing a "solid" hot plate the object to aim at is to utilize in the utensil as far as this is possible the whole of the heat units developed by the burner, and that the "solid" hot plate should only take up such heat units as the utensil cannot absorb. If utensils are standing on the "solid" hot plate, they take up some of the heat units which would otherwise be lost. With the system that the makers have adopted in the "Eagle" gas-range, whether there is a "solid" hot plate or an open one, the flame impinges upon the utensil only, and there is perfect combustion. In addition to being available with completely open hot plates in all sizes, the "Eagle" gas-range can be supplied in the fourth and fifth sizes with the hot plate wholly "solid," or partly "solid," and in the second and third sizes with part of the hot plate "solid."

### Reduction of Height.

Before taking leave of the hot plate, an interesting feature of convenience should be noted—the fact, namely, that as a secondary result of an innovation in the construction of the oven, to which reference will be made presently, it has been rendered possible to lower the total height of the cooker to an appreciable extent as compared with the usual height (a feature which will earn the gratitude of housewives and servants who have occasion from time to time to lift heavy vessels and place them above the burners); and at the same time there is provided actually a greater available space between the hot plate and the top of the oven. This is an arrangement specially useful for warming plates.

### Oven Reconstruction and Economy.

Coming to the oven, one receives the same impression of old traditions having been put on one side and a new view taken of present-day requirements and of the means by which these are to be met. The oven is of unusual width, and is rather less than usual in vertical measurement. But the feature of striking novelty is that cooking can be carried on right down to the bottom of the oven, with the result that while the cubic oven-space is rather less than that in the ordinary cooker of the same size, there is actually a greater available cooking space—every part of the oven-space being at effective cooking temperature. In other words, the "intensive" quality which is characteristic of the boiling burners and the grill, is also a feature of the oven; and where every cubic inch of cooking-space is made use of, it is obvious that the work can be done with the minimum of total space. To this result (as inspection reveals) important contribution is made by the use of a solid bottom-plate in the oven, which absorbs the heat from the burner immediately beneath and distributes it equally right up throughout the oven-space. To economize the oven-space is naturally to economize the amount of gas consumed, because there is less space to be heated.

And here another saving in gas is claimed. Though the oven has a solid bottom, this (together with the whole of the internal parts) can be lifted out so as to leave the oven entirely open at the bottom for cleaning purposes. With the "Eagle" gas-range, pastry can be browned in any part of the oven without the use of a browning-shelf; and the usual drip-pan can be dispensed with. Although the height of the oven is reduced, yet two tiers of bread can be baked simultaneously. A convenient variation, as compared with the usual type of cooker oven, is the fall-down door. It has spring hinges, to prevent jarring, and instantly gives a full opening for an inspection of the oven and will be found a handy temporary rest for vessels being put in or taken out. A further convenience in inspecting the oven is due to the cooker being raised upon legs, so that the interior is a convenient height from the floor. The oven burner has a new contrivance similar to those in the hot-plate, by which, after being full-on for a sufficient time for the oven to be properly heated-up, the tap lever can be further pushed, till it stops, and the gas is thus turned-down to the lowest amount which will maintain the oven at full temperature. The gas saving effected by this action is too obvious to need fuller statement; but the saving can be still increased if the flue-valve is at the same time closed by the knob provided in front.

### Miscellaneous Changes.

The convenience of the front tap-rail, both in accessibility and in readiness for any recess or corner position, has been sufficiently experienced to make the front tap-rail fitted to all these cookers a welcome feature; and among other thoughtful refinements of detail the making of the oven-tap lever of a pattern quite distinct from the others will be appreciated. The enamelled crown-plate has a trough in front, to prevent anything that boils-over from running down the front of the stove.

Quite a fresh departure is introduced in the plate-rack. This—instead of consisting of the usual bars—has a detachable wire mesh, which enables a spoon or any small utensil to be placed on it without risk of it falling through. Perhaps one of its greatest advantages is that in cases where cakes and pastry have to be placed on sieves after being taken out of the oven, in order that they may not become sodden, they may be placed instead on the wire-mesh plate-rack—an advantage that has been verified by the test cooking operations carried on with the "Eagle" gas-range. The plate-rack is light and strong, and no part of its supports cover the hot plate.

The enamelled splash-plate at the back is placed a short distance away, so that it ensures the whole of the hot plate being available for use, and offers no crevices for the collection of dirt and grease. The folding arrangement of the actual rack itself is very light, simple, and neat. The makers feel that no cooker is really complete without a plate-rack and splash-plate; and they believe that, owing to the advantages offered in this new type, very many more will be used than hitherto.

The outward appearance of the "Eagle" gas-range is a very prepossessing one; light and bright, with white enamelled outer door-plate and nickel-silver mouldings—which latter is a labour-saving arrangement. In fact, everything has been done to avoid surfaces where dirt or grease may gather.

Gas authorities, to whom maintenance is such an important question, will appreciate how this matter has received every consideration from the manufacturers in designing the cooker, and incidentally may be mentioned the saving in their not having to include in their maintenance the provision of drip-pans. The cast-iron feet on which the cooker is raised can be detached and packed within the oven, and so minimize breakage in transit.

Altogether an inspection of the "Eagle" gas-range, and a study of the many gas savings and the other advantages claimed for it, cannot fail to make a deep and lasting impression on the mind. It is not an improved gas cooker but a new gas cooker; and in this latter character it has a manifest claim to be reckoned with, as embodying potentialities which cannot but exert a powerful influence on the domestic uses of gas in the immediate future.

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[We learn that, owing to manufacturing difficulties, the makers are not yet in a position to commence delivering; but they hope to find themselves able to supply at an early date the size likely to be most in demand for average family use, and the other sizes will follow in due course.]

## Coke Breeze Briquettes.

A description of the "Koxit" process of making coke-breeze briquettes has appeared in the "Journal für Gasbeleuchtung," from the pen of Herr Kayser. By the ordinary process, coke breeze requires from 9 to 10 p.ct. of pitch as a binding material; but in the "Koxit" process, part of the pitch is replaced by a cheaper fluid binder consisting of oil-gas tar and vertical-retort tar in about equal quantities. The mixture of coke, pitch, and binding medium is heated with superheated steam and pressed into egg-shaped briquettes. In a series of trials, a satisfactory briquette was obtained by the addition of about 5 p.ct. of pitch and from 0·8 to 1 p.ct. of the liquid binder. The air-dried briquettes contained about 3·5 to 4·5 p.ct. of water and yielded about 14 to 16 p.ct. of ash. The calorific value was 6400 to 6600 calories. The quantity of water taken up when the briquettes were stored under water for seven or eight days ranged from 13 to 18·6 p.ct., as compared with 11·9 p.ct. for lignite briquettes under similar conditions. The loss of weight after transport by rail, unloading, and storing for six months was, in three tests with large quantities (3 to 7 tons), 4·1 to 6·3 p.ct. For preference, the pitch should have a softening point between 60° and 75° C. For steam-raising purposes an addition of from 20 to 25 p.ct. of coal dust is generally necessary to secure good combustion. The briquettes do not crumble when burnt. The coking effect is increased by the use of liquid binders capable of acting as solvents for the pitch—such as anthracene oil, &c. Very viscous binding material is not suitable, as by its use air is entrapped in the pores of the coke-breeze, and the briquette on subsequent combustion probably crumbles, owing to the expansion of the entrapped air. A process has been patented whereby this effect is reduced by adding the liquid binder under reduced atmospheric pressure. The total cost of manufacture—including establishment charges, cost of material, and labour—since the commencement of the war has amounted to about 7s. 8d. per ton. The sale price, determined by the relative calorific values of the fuels, is about 14 to 15 p.ct. lower than that of coke. The above particulars are taken from a recent issue of the "Iron and Coal Trades Review."

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**Fined for Estimating a Gas-Meter Reading.**—Estimating a gas-meter reading in Chicago is punishable with a fine and imprisonment, according to a decision of Judge Haas of the Shakespeare Avenue Police Court. He fined a Chicago meter-reader for this offence and "placed him on probation for a year, during which he must attend church regularly." This, the "Gas Record" of Chicago states, is the first ruling to be made by the Court on the section of the state public utilities law.

**Hours of Work in the Chemical Industry.**—The Chemical Employers' Federation have fixed May 1 for a joint conference at Manchester to discuss the question of shift workers and district agreements. The report of the Chemical Trade Joint Industrial Council shows that the Chemical Employers' Federation found themselves unable to concede the 44-hour week at present. The Chairman (Mr. Roscoe Brunner) said that the 47-hour week had so recently been introduced that it had been impracticable as yet to ascertain its results on output; and the Federation could not make any further concession, especially in view of the fact that the hours question generally came within the purview of the proposed National Industrial Council.

# ELECTRICITY SUPPLY MEMORANDA.

Imitation is the sincerest form of flattery. The electrical industry has now its Electrical Development Association, which is the nearest approach to the British Commercial Gas Association that can be found. It is not quite the same. Its basis is somewhat different. Our "B.C.G.A." is supported direct not by organizations, but by the gas undertakings of the United Kingdom and the manufacturing firms—true in this instance through the agency as collectors of their organization, the Society ot British Gas Industries. The Electrical Development Association has several foster parents—the British Electrical and Allied Manufacturers' Association, the Cable Makers' Association, the Tungsten Lamp Association, the Electrical Contractors' Association, the Incorporated Association of Electric Power Companies, the Institution of Electrical Engineers, and the Incorporated Municipal Electrical Association. It is stated that there are some municipal supply undertakings and the London Electric Supply Companies pledged to assist in finding funds; but the Provincial Electric Supply Committee has not yet come into line. However, the Association starts with a broad, substantial, and influential base; and we can promise it that just as the existence of the "B.C.G.A." has stimulated the electrical organizations to start a Development Association, so its existence will not lessen the energy that will be put into the work of the "B.C.G.A." But, of course, the Electrical Development Association will snap its fingers at this; seeing that the "Electrical Review" says "the first essential to success is to have a good thing to sell. We have it." The other day, too, it was boasting, when dealing with Sir Dugald Clerk's paper, of the superiority of electricity to gas practically all along the line. This, of course, is merely a bragging attitude; and we are not sure whether there is a little hypocrisy in it, or an open avowal of ignorance of the true facts.

**The Electrical Development Association.**

**The Work of the Gentle Hun.**

But although it has such a remarkably good thing to sell, it seems that the electricity industry has shown considerable ineptitude in selling it. As we gather from the electrical prints, electrical men have paid more attention to economies at the generating end, as expressed by the consumption of from 2½ lbs. to 16 or 17 lbs. of coal per unit, than to fostering the sales of electrical energy. Yet elsewhere in its article, the "Review" says that, during the fiery ordeal through which we have been passing, there has been an increase of some 80 p.ct. in the annual output of electricity. It seems that it has not been the electricity industry that has brought this wonderful achievement to pass. It is singular, we read, "that it should have been left to the Huns to administer this gigantic impulse to the industry." This is a remarkable confession. Electrical men will not like it. But it occurs to us that perhaps the electricity industry would find it cheaper and more effective to employ a few gentle Huns to carry on this work of business expansion than to run the Development Association. Of course, the output development of the past five years has been very largely of an adventitious nature. We know full well that in the main it has not been the ordinary run of business on which the industry has to permanently depend. It is in the ordinary run of business where the difficulties of competing with much cheaper B.Th.U. present themselves.

**Beauchamp at the Head—Finance.**

Mr. J. W. Beauchamp, who has been Electrical Engineer at West Ham the past six years or so, and was formerly assistant at Tunbridge Wells, has been appointed Director of the new Electrical Development Association; and he it is who is going to match his skill against that of Mr. F. W. Goodenough and the staff of the "B.C.G.A." Mr. Beauchamp will find these all very good fellows, and quite ready for a sound straight rivalry—rivalry with a backing of solid facts, and not petty postulation and slander, which are the weapons of the coward. He will, of course, obtain considerable help in the future—at least, so it is supposed if the plans materialize—from the supply of low-priced electrical energy, when the national scheme relieves all electrical men from the monopolizing work of seeking generating economies, and leaves them free to spend their time and energy upon distribution and sale. There seems to be some doubt as to financial contribution being general. Such a large proportion of the electricity supply industry is in the hands of local authorities; and, according to the "Review," there seems to be a little dubiety abroad as to continued support by them. "Electrical Industries" also remarks that the prospects of the Association are not entirely serene. This contemporary is looking for trouble before the Association gets well afloat. "Great difficulty," we read, "will be found in persuading the majority of undertakings to give the Association anything like the support it deserves. And as soon as the Association gets to work, it will encounter the type of criticism which is more concerned about details than about broad issues, more willing to waste time in pruning schemes with a view to achieving an impossible perfection than to accelerate useful work." In his desire to whip-up the niggardly, "Meteor" of the "Electrical Times" has recourse to a little invention, by stating that he believes the annual resources of the "B.C.G.A." are now nearing six figures.

**The Main Object, and a Great Faith.**

It is seen that the "primary" objects of the New Electrical Development Association are to encourage engineers, architects, builders, &c., and to educate the public generally, to make the fullest possible use of electricity; and to collect, co-ordinate, and distribute data of interest to members of the Association. Though these are the primary objects, the "main" one is found in this statement: "It is evident, from the success already achieved, that a concentrated and determined effort only is needed to replace by electrical methods the older services for industrial and domestic purposes." An extraordinary faith is shown here; and as gas is an "older service," we may take it that its "replacing" by electrical methods is one of the anticipations of the founders of the new organization, who do not appear to be quite certain as to the permanent security of their own child.

**The Right to Apply Rules.**

The electricity supply industry, the Board of Trade, the Home Office, and the London County Council have rules and regulations for the supply of electricity under different conditions. The Institution of Electrical Engineers have also a few score, which have been revised from time to time; and the Fire Offices have their own particular productions where they have not adopted those of the Institution. Now we cannot think that all these have been designed and put into force without power and for very good reasons. If there are good reasons, the rules and regulations are fully justified. In an article by Mr. Charles A. Baker on the "Rules Imposed by Electric Supply Authorities"—that is to say, not the central authorities, but those who have direct business relations with the users of electricity—he appears to question their right to impose them, because, as we understand him, he cannot find any specific power given to inflict them upon the would-be consumer. If he looks under the word "Regulations" in the index to Shiress-Wills' book, the "Law relating to Electric Lighting, Traction, and Power," he may find reason for altering his views. He regards the formidable rules laid down as being in excess of any logical requirement; and no doubt many of them are. Some of them, too, are said to be discouraging to the consumers. But the truth is that those who require electricity are faced by the fact that other users of electrical energy have signed the very same rules, and have not found them irksome. Otherwise there would be more electricity supply undertakings on the road to ruin, if there were not rates upon which local authority electric undertakings can with much facility fall back for maintenance. As a matter of fact, there are not many consumers who trouble to read through the rules; and of those who do glance through them, there are comparatively few who understand what they all mean. The only point that interests us is as to whether the power exists to lay down these rules. Mr. Baker holds that, under their Provisional Orders, a supply authority is bound to lay mains on being required to do so, and to supply energy. The obligation, as we understand him, is there to supply; and nothing is said about rules. On the other hand, the undertakers may require the would-be consumer to enter into a written contract. One justification for rules, it appears to us, is found in the provision that the undertakers shall not be compelled to give a supply unless reasonably satisfied that the electric lines, &c., are in proper order. The only thing the supply authority is specifically prohibited from prescribing is a special form of lamp or burner. It may be fairly assumed from this that the supply authority would have been specifically excluded from the making of rules affecting the general wiring had that been the intention of the Legislature. But the fact remains that there is no such prohibition. In another part of his article, Mr. Baker admits the right to test, but not the right to inspect an installation. How can an authority be reasonably satisfied that the electric lines, &c., are in proper order unless allowed to inspect as well as to test? It is quite obvious that some shoddy installations might pass a test when new; but on inspection the supply authority might find that the day would not be far distant when an installation would not stand the test that was applied when everything was new, though poor. In looking around to ascertain how some of the rules have come to be applied, Mr. Baker suggests that "one or more of the directors or town councillors may have suggested that a water or gas or other commercial undertaking with which he was associated found a certain rule useful, and therefore applied it to the electrical undertaking without regard to the fact that the latter is a statutory undertaking, with important duties to the public, and with strictly limited powers in the direction of imposing rules." Is not Mr. Baker aware of the fact that all important gas and water concerns are statutorily governed?

**Water Heating Still an Ambition.**

"Electrical Industries" has published a digest of a paper which Mr. H. O. Swoboda has read before the Engineers' Society of Western Pennsylvania, in which the author has tried to inspire greater hopes as to the prospects of heating water electrically. We have carefully read through the article with the view of finding substantial ground for hope, but it cannot be said that there is any disappointment in seeing that the position is not in any whit altered. Those who may take Mr. Swoboda as the embodiment of all wisdom on this

matter must not feel aggrieved when, by the application of a little common sense, it is afterwards found that the raising of the temperature of water cannot be achieved without the utilization of B.Th.U., and that the greater the time required to heat-up water in bulk the greater must be the loss of heat by the various routes that its dissipation always takes. Electric water heating, says Mr. Swoboda, "appears to be one of the modern methods of doing things which conquers its field of utility in the world, in spite of high cost, until it is finally recognized as a necessity with which present methods cannot compete at any price." There is caution in the word "appears." Hot water is a universal necessity; and every household and industry require it in large quantities. In the competition between the various methods of obtaining hot water, the relation of economy—cost and time—to production must always be a paramount consideration, and the system which can produce large bulks of hot water quickly, at comparatively low cost, and with saving of labour, will always take the lead in magnitude of adoption over systems more costly and less efficient. However, we will do Mr. Swoboda the justice of saying that he is not particularly strong on the electric heating of water in bulk. In fact, he points out that "the amount of electric energy required for heating water is larger than for any other solid or liquid substance, and the central stations could not, and in a great many cases cannot yet, see their way to overcome this obstacle by offering special low rates for their energy." Heating of large quantities of water leads to the dilemma that a long period with moderate consumption, or a short period with heavier consumption than the central station engineer desires, is necessary. In this connection he states that in America the circulation type of water-heater is being used with considerable success. In principle and in appearance, it is similar to the gas-geyser, but "while the geyser has a very poor heat insulation, the electric-heater can be so efficiently lagged that a 30-gallon boiler will lose only 250 watts per hour." Mr. Swoboda must know that a gas boiler or geyser could be lagged beyond all recognition were it necessary; but it is not. With gas types of water-heaters, there is rapid service; and the more rapid the service, the less the heat loss. The electric water-heating appliances that Mr. Swoboda has in view as an introduction to this field of business appear to be somewhat in the nature of novelties, and not appliances with a large quantitative range of utility. He mentions the instantaneous type of electric water-heater, which will give a trickle of hot water, and has very limited range of practical application. Instantaneous electric water-heaters supplying large volumes of water have opposed to them certain physical drawbacks which are reflected in the cost of construction, and which have an imperturbability that causes vexation to every electrical man who sets out to conquer.

## PETROLEUM POPULARLY DEALT WITH.

The latest volume that we have received of Pitman's Common Commodities and Industries Series is entitled "Petroleum;" and the author is Mr. Albert Lidgett, the Editor of the "Petroleum Times," who set himself to deal in a popular style with a subject which has, of course, already been written upon by various authors in a more advanced manner. These are days when everyone wishes to know something about oil; and this "something" can be gathered at small pains and trifling cost by perusal of Mr. Lidgett's volume, which is published by Sir Isaac Pitman & Sons, Ltd., of Amen Corner, E.C. 4, price 2s. 6d. net.

The fourteen chapters into which the book is divided are written in language free from technicalities; and the chief phases of the petroleum industry are explained in a manner which should certainly accomplish the author's purpose, by proving acceptable to the general reader. The importance of the subject is emphasized in his preface by Mr. Lidgett, who says: "In no sphere of commercial and industrial activity has greater progress been made during the past few decades than in regard to the multiplication in the uses of the products of petroleum. The avenues for advantageous consumption are constantly increasing, and this to such an extent that the production of crude petroleum—enormous though this is—has been outstripped by the demands for the refined product." The book is illustrated by a number of photographs and sketches; and there is a diagram showing the products of petroleum by fractional distillation.

One of the chapters deals with the Scottish shale oil industry; the retorting and subsequent processes being explained. In the chapter on internal combustion engines, reference is made to the Vickers' patent system of fuel injection, for doing away with an air-compressor with engines of the Diesel type—*i.e.*, using heavy oil. The concluding statistical chapter reveals the remarkable strides that are being made in petroleum production in different countries.

**Society of British Gas Industries.**—The annual general business meeting of the Society—to be held in the Connaught Rooms, Great Queen Street, on Wednesday, May 7, at 12.15—will be followed by luncheon; and thereafter (at 3 o'clock) the members will be addressed by the President (the Right Hon. Lord Moulton, K.C.B., G.B.E., F.R.S.), and there will be the induction of the new President (Sir Arthur Duckham, K.C.B.). The proceedings will close with afternoon tea.

## THE MANUFACTURE OF NEUTRAL SULPHATE OF AMMONIA.

### A New Process.

Much interest is being shown at the present time in the matter of raising the standard of quality of the sulphate of ammonia generally supplied in this country. A strong movement is in being to persuade or compel manufacturers to eliminate the free acid which is a normal constituent of the sulphate ordinarily supplied. Such free acid is detrimental both to the transport and use of the salt. It rots the bags in which the salt is packed, and seriously impedes the agriculturist in his efforts to secure an even distribution of the material in the soil.

It is not surprising that sulphate of ammonia which has been produced in the usual manner, should contain free acid. The crystals of sulphate are deposited in a bath, which consists of more or less dilute sulphuric acid in association with a solution of sulphate of ammonia. As these crystals are removed from the bath, they are, of necessity, surrounded by, and enveloped in, mother liquor containing free sulphuric acid. Part of such acid drains-away when the salt is allowed to rest; but a portion is left adhering to the crystals, and constitutes the free acid which is being objected to. In amount, it varies from 0·3 to 1 p.ct. by weight of the salt; an average amount being about 0·5 p.ct., where no special means are in use for its removal.

There are two ways by which this objectionable constituent may be got rid of. It may be eliminated, or it may be neutralized. For example, the salt may be washed with water, as in the following arrangement, for which a British patent was granted a year or two ago. There was an endless chain of perforated buckets dipping into the contents of the saturator, and raising therefrom the crysals of sulphate, which were met by a shower of water applied on the countercurrent principle—that is, the sulphate encountered progressively clearer or fresher water as it moved towards the discharge end of the conveyor. Thus the salt received a very effective washing, eliminating the free acid. But, unfortunately for the success of the process, the washing cannot be applied without at the same time some of the sulphate itself being dissolved. This is a very grave objection, and has prevented any extensive adoption of this method of washing the crystals of sulphate with water.

There are several patented methods for getting rid of the free acid by neutralizing it. In one, the salt is exposed to vaporized ammonia, which is caused, by suitable means, to permeate the material. In others, a solid material containing ammonia in some weak combination is mechanically mixed with the sulphate which is to be made neutral, so that the free acid in the latter may combine with the ammonia that is presented to it. These methods of neutralizing the free acid by means of added ammonia, in one form or another, are quite efficient if properly carried out; but they are necessarily more or less expensive, seeing that the ingredient which is introduced into the sulphate must be brought into intimate contact with the latter, necessitating very careful mixture of the materials. Neutralized sulphate is said to be liable to become discoloured; and this is easily understood. For if an excess of ammonia be present in the material, it will precipitate, as oxide, the trace of iron which exists in practically all commercial sulphuric acid.

We have now to describe a method which, by the introduction of a simple modification of the ordinary working arrangement, eliminates free acid from the resulting sulphate at practically no expense. This is the process devised by Mr. J. T. Sheard, the Chief Chemist to the Sheffield Gas Company, whose complete specification has just been accepted by the Patent Office. The process is based upon a realization of the fact already alluded to, that every crystal of sulphate of ammonia, as it is removed or delivered from the saturator, is enveloped in a film of sulphuric acid, which in the ordinary course is too viscid to flow completely from off the surface of the salt. If, now, this film of acid can be diluted with water, so as sufficiently to reduce its viscosity, it will be enabled to flow away from the salt, leaving the latter practically neutral. In this process, therefore, the mass or magma of crystals enveloped in mother liquor and acid, is surrounded by a fine mist or cloud of water, immediately it leaves the saturator, and before the mother liquor has been allowed to drain away from it. The acid film enveloping the crystals of sulphate has a great avidity for water, which it absorbs, and is diluted by, while the salt is protected from meeting with the water, and so is not dissolved; for the water does not come directly into contact with the salt itself. The diluted mother liquor, which drains away from the salt, carrying with it the free acid, flows back into the saturator. It might be thought that this would lead to too great weakening of the saturator bath; but this is not so. It is duly allowed for. In the ordinary way of working, a supply of water, equal to 112 gallons per ton of sulphate made, must be provided, in some form or other, in order to reduce the strength of the acid employed—namely, 140° to 80° Twaddel, which is that generally considered the most useful. By the arrangement described, so much of the water as is necessary is used to dilute the acid on the surface of the salt removed from the saturator, before it enters the saturator itself.

A Proclamation dated the 25th inst. removes from the list of prohibited exports asphalt; asphalt, coal tar; and bitumen.

## SOME OBSTACLES TO THE PROGRESS OF THE GAS INDUSTRY.

By Norton H. Humphrys.

At meetings of gas engineers, and in the Technical Press, one frequently comes across remarks to the effect that war experiences have greatly extended the ideas of technical gas men, and that distinct advancement on the current run of commercial and technical ability is required, if the present situation is to be effectually dealt with. On behalf of Mr. Lloyd George, a plea was put forward that the man who had won the war was best fitted to arrange conditions of peace. The same applies to the gas engineer. The manner in which the stupendous difficulties brought about by war conditions have been encountered does not support the view that the gas engineer is not up to date as regards present-day requirements. Partial or complete stoppage of the gas supply has been the exception, not the rule; and, in view of labour shortage, there has been a remarkable absence of insufficient purification. The evidence favours an assertion that the technical and commercial ability that has been applied with such conspicuous success during the last five years is quite adequate for successfully dealing with peace problems.

It is nearer the mark to say that he has been freed from encumbrances and restrictions—frequently so onerous that he could scarcely call his soul his own. He was simply an executive officer, running in a narrow rut, built-up by the regulations of a Special Act, or by directors chiefly engaged in other pursuits that left no leisure for anything approaching live interest in the gas industry, either individually or collectively. Many of the gentlemen concerned in the administration of the smaller class of gas undertakings, receive merely a nominal fee for their services, and do nothing beyond policing the concern at board meetings. Only such a disaster as the destruction of a gasholder will meanwhile direct their attention to the gas-works. The effect of extended ideas due to war conditions is more prominent in the board-room than in the manager's office. There is an all-round rattling of the dry bones, and especially a recognition of the fact that the commercial department requires management as much as the technical side. Government authorities are still wedded to hoary tradition, as shown by the fact that modifications of existing capital, dividend, and maximum-price clauses could readily have been made to synchronize with the diminished value of money and the increased cost of material and labour, and without involving costly and cumbrous procedure for which the consumer eventually has to pay. If the National Gas Council can pierce the rhinoceros-like hide. and bring about up-to-date changes in the views favoured at the Board of Trade office, both the national interests and the gas industry will be benefited.

But all this is a long way from the capabilities of the technical or commercial management. Even forty years ago, there would have been no difficulty in finding men anxious to tackle present-day problems, most of which have been always with us in one form or another. Mr. Thomas Settle was carrying out practical trials of "steaming" in horizontal retorts twenty years ago, but found they were not compatible with an unusually high photometrical standard. Dilution with "blue" gas is by no means a previously unheard-of novelty; and as much can be said of maintenance schemes or fittings on hire.

In theory, the development of private enterprise should be stimulated, certainly not stifled. Yet progress in the gas industry has always encountered opposition in quarters where one might reasonably look for sympathy and encouragement. There is nothing of a disreputable character about extension and development to a degree that necessitates an enlargement of existing powers. Yet the local authorities (representing the consumers) seem to think otherwise, and that it is their duty to build-up a factious opposition that is frequently more or less fictitious, with the avowed object of discounting the advantages sought for; and the skill with which their programme is carried through the Parliamentary Committee-room will largely affect the ultimate result. A small concern does not want to be loaded with an incubus of dead-capital, representing the cost of conducting a contested application. Directors recognize that applications to Parliament may mean a costly fight, and an unsatisfactory issue; and the result is a strong inclination to keep clear of Westminster, and to conduct a limited business on safe lines, as a preferable alternative. In many parts of the country, the progressive engineer, now generally in demand, has not for this reason found himself in sympathetic environment.

Two directors of a provincial gas company were lately discussing the actions of their manager, and one remarked disparagingly that he was always wanting to spend money. The other considered that outlay should be limited to excess profits. The fact was the resources of the existing shareholders in the matter of raising additional capital were limited; and the directors did not wish to bring in new blood, which might possibly mean changes in the constitution of the directorate. Views of this character are by no means the exception; and recent experiences are not encouraging. The enterprising and progressive concerns—as instanced by frequent and consequently the more recent applications to Parliament—are hit the hardest. The acceptance of a reduced maximum price for gas has caused the necessity for taking advantage of the Temporary Increase of Charges Act, one of the benefits [!] of which is a substantial reduction of dividend. Legislation has hitherto aimed at the encouragement of enterprise and the penalization of slackness; but the enactment of 1918 has exactly the opposite effect.

Given reasonably fair treatment in the matter of finance, that will maintain the value of the property, and yet allow new capital to be placed at a premium; either the entire removal or else the modification of quality clauses that will secure full liberty to give the best possible value at the lowest possible price, as influenced by local conditions; a cessation of vexatious, and to some extent useless, restrictions on sales of gas and residuals; and stoppage of the discreditable practice of forcing the purchase of large proportions of useless dirt and dust at the full controlled price of genuine gas coal—there will be no lack or deficiency in technical ability able and willing to exploit the position to the best advantage. Even under existing regulations, one occasionally hears of enterprise and ability of such robust character that it cannot be stifled by the directors or by the Board of Trade.

Fully-qualified men are at present available, and have been in existence for many years past. But they are not unearthed and brought to the front by advertisements offering a vacant post to the man who will take it for the lowest salary—a condition that at best is negative evidence of the highest qualifications, or terms that are barely equivalent to the wages now paid to a leading retort-house hand, or by severe limitations in the matter of "outside work" with no adequate consideration, that cause the best class of candidates to consider whether it is worth while to burn their boats, as one means of securing a position subject to three months' notice. Given relief in the direction above indicated, the executive will rise to the occasion. But if these cannot be obtained, the manager should not be saddled with blame that is justly attributable to misplaced legislation, or ignorant board-room administration.

### Objects of Extensions.

The main objects for enlarging a business of any description, are to improve stability and to increase its profit-earning capabilities. If this is not accepted, it is difficult to find a reason for extensions; and a shareholder in a gas undertaking when invited to vote in favour of an application to Parliament for an increase of existing powers, would do well to seriously consider his position before complying. The addition of capital, on terms not more favourable to the investor than have obtained hitherto, and of obligations that will increase rather than reduce facility for working on the best practicable terms, are likely to benefit all concerned—consumers as much as shareholders. The same cannot be said for more stringent obligations as regards quality and purity, and terms that are prohibitory to raising capital at a premium.

A common fallacy is the notion that a reduction of dividend is necessarily an advantage to the consumer, which is accepted by those who have been honestly acting according to their belief in the interests of consumers, by opposing the claims of gas companies to the maintenance of their pre-war rates. The individual shareholder would receive less; but the total sum required as loading on the business done would not in any case follow suit. It might move in the other direction. This was in the past the faith of Parliament that the capital value of the statutory compared with the non-statutory gas company was always higher in public estimation. Recent experiences may cause the difference to disappear. Many of the latter are to-day the more desirable investment; and apart from changes in the value of money, the statutory concern has suffered a decided setback, and under present conditions cannot raise money on anything approaching pre-war terms. This means that the cost for interest, per 1000 c.ft. of gas sold, which is a factor directly interesting to the consumer, will be greater and not less.

## TAR AND OTHER OILS FOR POWER PURPOSES.

### The Crossley Cold-Starting Oil-Engine.

There has been issued by Messrs. Crossley Bros., Ltd., of Openshaw, near Manchester, an abridged report of a series of independent tests of a Crossley cold-starting oil-engine, by Prof. F. W. Burstall (Professor of Mechanical Engineering at the Birmingham University), who says: "The results, both of my test and my observation on the working of the engine, lead me to express the opinion that the Crossley oil-engine represents probably the highest development of the heat motor at the present day, taking into account its great simplicity, its low compression, its suitability for being handled by unskilled labour, and the remarkable way in which it appears to be able to work equally well on all qualities of oil." The engine on which the tests were made was rated at 117 B.H.P. as a normal working load with residual and tar oils. It had a cylinder of 18½ in. diameter, a stroke of 28 in., and ran at a speed of 180 R.P.M. The tests extended over a period of nearly two weeks.

With regard to the report, Prof. Burstall points out that he is considering only the heavy-oil engine, and that the results and conclusions must not necessarily be taken to be equally true in connection with either the gas-engine or the petrol or paraffin engine. By heavy oil is meant crude or residual petroleum (or even tar oils) composed of paraffin compounds, together with the aromatic oils having a boiling-point lying above 150° C. Such oils are highly complicated combinations of carbon and hydrogen; and while they have a high heating value, they burn with difficulty

and with a very smoky flame under ordinary conditions. One of two alternatives may be taken: The first is the use of heat to gasify the fuel before ignition takes place; while the second is to subdivide the fuel by some means into such minute particles that it will combine with the oxygen of the air completely during the time allowed for the working cycle. The first method is that adopted in what is commonly known as the "hot bulb" engine. The second (the atomizing of the oil) is the one used by Diesel; and Prof. Burstall says it may be taken to be the most successful method of ensuring the complete combustion of a heavy oil, though the use of compressed air at a pressure as high as 60 atmospheres (900 lbs. per sq. in.), and higher, certainly adds in no small degree to the complication of the Diesel engine, and to the risk of breakdowns, besides adding materially to the capital cost of the engine. The Crossley heavy-oil engine consists generally of their standard pattern horizontal gas-engine as regards bedplate, cylinder, and the general frame of the engine, with the addition of an oil pump operated by a cam on the half-speed shaft and conveniently placed in an accessible position near a fuel injector, through which the oil is sprayed into the combustion chamber. Among other novel departures in the engine are the shape and the disposition of the combustion chamber, the construction of the oil injector, the method of starting without preheating, and the means of governing the fuel supply—all of which are quite simple.

The perfect regularity of ignition of the Crossley engine under all loads, and with any class of heavy oils, including tar oils, is, says the report, remarkable. As compared with the Diesel engine, the compression pressure is very low, especially considering that the engine has no hot bulb, and was started from the cold state on every occasion with unfailing regularity, and without preheating of any sort whatever. The pressure of the compressed air used for starting purposes was only 130 lbs. per sq. in. There does not appear to Prof. Burstall to be anything to prevent engines being constructed with much larger cylinders than that on the engine which he tested.

Coming to the actual tests, Prof. Burstall states that the figures obtained are highly satisfactory from the point of view of the extreme fuel economy of the engine. He describes the method of procedure adopted, and says the engine was tested under a variety of loads with refined kerosene, residual petroleum, and tar oil. In the last case, the charge was ignited by injecting a small quantity of refined oil ahead of the main tar-oil injection. Before and after the tests, the piston and valves were withdrawn, so that the interior of the cylinder could be inspected. After four days of testing under all loads and conditions, there were no carbon deposits on the piston, valves, or combustion chamber; the engine being as clean as if it had been worked on town gas.

*Summary of Tar Oil Tests.*

Calorific value, 16,200 B.Th.U. per lb.; 9000 calories per kg.

| B.H.P. | Oil Per B.H.P. Per Hour. | | Heat Units Per B.H.P. Per Hour. | | Thermal Efficiency on the B.H.P. |
|---|---|---|---|---|---|
| | Pounds. | Grammes. | B.Th.U. (Lbs.-Fahr.) | Calories (Kg.-Cent.) | |
| | | | | | Per Cent. |
| 146·0 (25 per cent. overload.) | 0·514* | 233 | 8,420 | 2122 | 30·22 |
| 129·0 | 0·504 | 228 | 8,207 | 2068 | 31·01 |
| 102·0 | 0·475 | 216 | 7,750 | 1953 | 32·84 |
| 67·0 | 0·488 | 222 | 8,140 | 2051 | 31·26 |
| 32·0 | 0·700 | 318 | 11,850 | 2986 | 21·47 |
| 0 | 10·16 lbs. per hour. | 4610 | — | — | — |

* These figures include a small proportion of kerosene used for ignition purposes.

It is remarked in the report that, as regards the brake horse power, the striking feature of the tests is the almost equal fuel consumption per horse power hour from normal load to half load. The absolute values of the brake efficiency in the Crossley engine are very high. A figure of 33·2 p.ct. heat efficiency on the brake horse power which appears in one of the tests on residual petroleum is, Prof. Burstall asserts, a most remarkable result for such a simple engine; and it will be perceived that the figures on one of the tar-oil tests are very nearly the same. On the full-load test with tar-oil, the amount of paraffin used for ignition purposes was only 3 p.ct. of the total fuel consumed. The temperature of the exhaust follows closely the power of the engine—ranging from 100° C. at light load to 465° C. on the overload.

**Bright Future for Gas.**—In a paper he read before the Wisconsin (U.S.A.) Gas Association, Mr. R. O. Jasperson said: Sometimes we hear people suggest that the gas business is *passé;* that no one uses gas if he can help it. I had an electric salesman apply for a position recently; and after a short interview I was satisfied that he felt it was considerably beneath him to represent a gas company. I made it my business to show him some of the things that are being done with gas; and he soon revised his opinion of the gas industry. It is not surprising when electric gentlemen get the idea that gas is out of date; but when gas men more than half admit that it is so, what can one expect? As a matter of fact, the gas business has just about scratched the surface; and if the men in the industry do their duty, the gas business will eclipse the past so completely that we will wonder at our own low estimate of its possibilities.

## COKE-OVEN MANAGERS' ASSOCIATION.

### (MIDLAND SECTION.)

A Meeting of the Midland Section of the Coke-Oven Managers' Association was held on Saturday last, at the Queen's Hotel, Barnsley—Mr. J. A. Wilson, of Staveley (the Chairman of the Section), presiding.

Mr. J. Thorp (Barugh) read the following paper on this subject:

### SOME FEATURES OF CARBONIZATION AND BYE-PRODUCT RECOVERY.

Although much has been done in the past to solve the problems of the economic carbonization of coal and the recovery of bye-products, the recent advances in the cost of coal make further effort imperative. Britain's position in the world's iron market was before the war seriously menaced by German competition; but with this competitor weakened, we have still to face that of the United States, whose output before the war was greater than that of either Germany or ourselves. It is also felt there will be greater rivalry from the East (with its cheap labour) for the supply of manufactured iron goods to the world's markets.

The prosperity of the mining, coking, and iron industries, is interdependent. Upon the coking industry devolves the problem pertaining to the conversion of fine-grade slack to a metallurgical coke containing a low percentage of ash, sulphur, and phosphorus. It has been a surprise to those engaged in the carbonization of coal with bye-product ovens and the other necessary plant when, in addition to the coke needed for iron smelting, it was vital that every effort should be made to recover the whole of the ammonia, benzol, and toluol, and especially at a time when there was an alarming shortage of coal, that the Government should have permitted the continued use of non-recovery bee-hive ovens, particularly when it was known that other countries have ousted them. Whether the preference of some iron smelters for bee-hive coke is entirely due to prejudice is perhaps not altogether true; and it behoves those responsible for the working of patent ovens to supply a coke equal in appearance and quality to replace it.

#### Gas-Works and Coke-Oven Practice.

No one process of carbonization has yet been invented which will supply at will all the nation's requirements of coke for iron smelting, smokeless fuel, and gas for heating and lighting. The coking industry can supply, when working regenerative ovens, a large amount of gas for town uses; and the problem for the future seems to be whether the community shall be supplied with electricity for lighting, and with smokeless fuel or gas for heating purposes. It is felt that there will be a greater concentration at the pit top of carbonizing plants other than coke-ovens towards this end. In coke-oven practice, the size and shape of the ovens do not differ much, and vary chiefly in the system of flues; but gas engineers are still struggling with their problem, which is very controversial. Much work has been done to compare the respective merits of horizontal, inclined, vertical (continuous and intermittent), and chamber retorts, &c.; and the tendency is to instal vertical retorts, and to strive to make a high gas yield rather than a smokeless fuel. The parliamentary sanction to ignore the candle-power standard has been the means of allowing higher heats and steaming to be done, enabling some extraordinary high yields of gas to be obtained.

Coke-oven practice is limited to the iron market; and as the ovens are usually worked in conjunction with the collieries, and presuming the possibility that the market for metallurgical coke had been met and there was a surplus of coking slack, other outlets may have to be considered.

To some idealists the solution seems to be the carbonization of coal to make as much gas as possible with the least residuum of coke, and the supply of the gas to electricity generating stations for the supply of current for lighting and motive purposes, and also to the community for heating purposes. To others, the manufacture of a smokeless fuel, containing about 10 p.ct. of volatile matter, with a high grade gas, seems to meet present conditions, and more within reach. The substitution of this fuel for coal would be a drawback where there is limited storage capacity (such as in flats), as 15 cwt. occupies the same capacity as 20 cwt. of coal. But it would find ready purchasers in large towns, that have been compelled to use, through the coal shortage, the coke that some gas concerns have supplied.

The tars from various systems of carbonization are interesting, as, being the condensates from the gas, they give to some extent a criterion of the conditions under which the coal has been carbonized. Four tests are given in the table on p. 248: (1) Horizontal tar from low heats. (2) Horizontal tar from high heats. (3) Coke-oven plant tar. (4) Dessau vertical retort tar. Nos. 2 and 4 are from Durham coal, carbonized under the direction of the same engineer.

In regard to test No. 2, the amount of tar acids is only about half the amount obtainable from Lancashire and Yorkshire coals, and the other finished products are also less. The separation of the fractions has been made according to the specific gravity, and not boiling point; and no attempt has been made to ascertain whether all the products were nitrifiable.

The outstanding features of vertical and low temperature tars are: (1) The large amount of tar acids they contain; but the yield

| — | | 1 | | 2 | | 3 | | 4 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Percentage $N.H_3$. | | Percentage $N.H_3$. | | Percentage $N.H_3$. | | Percentage $N.H_3$. |
| Ammonia water | gallons per ton | 4·94 | 0·55 | 10·53 | 0·35 | 6·59 | 1·58 | 3·25 | 0·38 |
| | | | sp. gr. | | sp. gr. | | sp. gr. | | sp. gr. |
| Crude naphtha | ,, ,, | 10·56 | 0·896 | 6·60 | 0·933 | 3·40 | 0·980 | 4·26 | 0·886 |
| Carbolic oil | ,, ,, | 22·92 | 1·005 | 4·03 | 1·005 | 11·10 | 1·005 | 62 26 | 0·993 |
| Creosote oil | ,, ,, | 38 36 | 1·040 | 33·03 | 1·040 | 49·44 | 1·040 | 8·95 | 1·040 |
| Blue oil | ,, ,, | 39·37 | 1·080 | 17·02 | 1·084 | 18·20 | 1·080 | 16 91 | 1·072 |
| Pitch | lbs. ,, | 1032·00 | .. | 1495·20 | .. | 1308·00 | .. | 1260·00 | .. |
| Lost in distillation | ,, ,, | 8·20 | .. | 9·43 | .. | 10·10 | .. | 17·23 | .. |
| | | 1 Ton | | 1 Ton | | 1 Ton | | 1 Ton | |
| The above yielding: | | | | | | | | | |
| Tar acids | | 10·20 | | 3·23 | | 7·44 | | 14·00 | |
| Crude pyridene | | 0·84 | | 0·25 | | 0·35 | | 1·96 | |
| Benzol | | 1·90 | | 1·45 | | 0·20 | | 1·06 | |
| Toluol | | 1·24 | | 0·61 | | 0·10 | | 1·17 | |
| Solvent naphtha | | 1·82 | | 0·89 | | 0·72 | | 2·46 | |
| Free carbon, per cent. | | 8·60 | | 17·50 | | 7·20 | | 2·18 | |

of phenols is even less than from inclined or horizontal retort tar. They consist mainly of high boiling point cresols, for which special markets are not readily found—the yield satisfying the soap makers' specification of 95 p.ct. at 203° C. not being as abnormal as the tests suggest. (2) There is a high yield of low sp. gr. creosote oil, which is very suitable as a burning oil or for making soluble liquid disinfectants. The ordinary large outlet for creosote before the war was for creosoting timber; a large amount being absorbed by the railway companies for sleepers, the preservation which to some extent is due to the pores of the wood being filled with naphthalene. As these tars contain very little naphthalene, they may not give the same satisfaction for this purpose. (3) The amount of free carbon is low. The whole of it is left in the pitch, which is sold as a binder for briquette manufacturing or road making. Obviously the lower the amount of free carbon means the better the pitch; but up to now purchasers have not offered any increased price for improved quality. (4) Considering the very large amount of distillates of low sp. gr., the yield of benzols-naphthas is relatively low and disappointing. Tars differ greatly; and the tests must be considered as indications rather than average examples.

The continuous vertical retort, which utilizes the heat of the coke to preheat the air required for combustion, gives the greatest economy in the consumption of fuel—using as low as 10 lbs. of coke per 100 lbs. of coal carbonized, compared with up to 15 lbs. per 100 lbs. for intermittent, vertical, and horizontal and inclined retorts; while in coke-oven practice, obtaining 50 p.ct. of surplus gas uses about 9 lbs.

### Bye-Product Recovery.

In considering any extensions of plant, provision must be made for the water supply needed for the condensers and for quenching the coke. Most coking plants use water pumped from the pits. This being subterranean water generally at a temperature of 9° C., is very suitable—in so far as it is cold—for cooling purposes; but owing to the high amount of temporary hardness generally found, due to the presence of calcium and magnesium carbonates, which dissociate at any temperature above 50° C., and scale the condensers, impair their efficiency, and cause additional condensers to be considered. Therefore efforts should be made to supplement this supply with surface water, to prevent its concentration; and the deposition can be lessened by increasing the flow through the condensers. Usually it is found that the supply of fresh water is insufficient; and most coke-oven plants have to instal coolers, either of the tower or spray fountain type. For the latter there has been some ingenuity to make nozzles give a spiral twist to split-up the water. The tower type are more generally popular, as they are considered more efficient and require no attention through nozzles getting choked-up.

In the indirect recovery of ammonia, a good absorption is not possible if the temperature of the gases exceeds 25° C., and much waste by evaporation can be avoided by properly hooding all seals and luting the liquor pipes, covering tanks, and working-up the liquor as soon as it is made. In the semi-direct and direct recovery of ammonia the great fear is a breakdown, as this not only means the loss of the ammonia but also that this is partially arrested in the benzol scrubbers.

Many breakdowns of sulphate of ammonia saturators could be avoided by a simple test applied to the chemically pure lead of which they are supposed to be constructed—the plumber's strips not being overlooked. The test consists of forming a Pb-Hg amalgam of 5 grams of the lead and 0·8cc of Hg, and heating to 130° Fahr. in a test-tube. The dross of good lead floats at the top; the dross of bad lead, being more abundant, separates far less readily. Good lead forms a silvery amalgam; bad lead has a bluish tint. By the Ba $So^4$ p.ct. test of sulphur, good lead was found to contain unweigh-traces and bad lead 0·00082 p.ct. of S. This low amount is insufficient to account for its misbehaviour, and in this case was probably due to one or several of the other combinations of unchanged lead ore.

### Benzol Recovery.

This was first done upon a commercial scale at a works in Manchester after the investigations of Wilfrid Irwin, F.C.S., and under his direction. It was he who adopted the gas sulphur test for estimating the amount of this impurity in benzol. In 1881 and 1882 the price of benzol was 15s. per gallon, and three Livesey washers were put down (later they were replaced by tower scrubbers) and gas was purchased at the Manchester Corporation Bradford Road Gas-Works, and a yield of 3 gallons per 10,000 c.ft. of gas was obtained. Later, carbonizing plants were put down specially for the benzol. Eventually, however, there was competition; and the market being satisfied, prices began to fall, and the plants were disbanded. The venture proved to be very remunerative.

To-day benzol vapours are absorbed from the gas in either tower or rotary scrubbers; care having been taken to thoroughly absorb the ammonia previously. Any ammonia present as Am. Cn. does great damage, especially to wrought iron, when heated in the still preheaters to above 100° C. The same action is found in the oil coolers, and because of this wrought iron is not serviceable at any part of the plant where this temperature prevails. The best oil for absorption is not necessarily the best for the still. For the still a certain proportion of light creosote is requisite as a medium in the distillation of benzol, or otherwise an excessive quantity of wet steam must be used to ensure the stripping of the benzolized oil. Cooling of the absorbing oil to 20° to 25° C. is essential for good absorption, and also avoids loss of oil through carburetting the gas.

In conclusion, Mr. Thorp said he had been in communication with Mr. Wilfrid Irwin; and he gave several extracts from letters from him in relation to his early experiences as an investigator in the matter under consideration. He thought these might be of interest to the meeting, as Mr. Irwin was probably the last left of the men who were interested in the subject in the earlier days.

### DISCUSSION.

The Chairman (Mr. J. A. Wilson, of Staveley) said there were one or two points on which he would rather like further enlightenment. It was a good many years ago since he had had to make a report to his firm on the subject of smokeless fuel. He had there raised the question of the friability of the fuel and the amount of dust which it would make in the ordinary handling from the maker to the consumer. He did not know whether Mr. Thorp, or perhaps some other member, could say the amount of dust it really did make. In regard to the low heat, he did not notice any statement in the paper as to specific gravity. In connection with the tar figures, it would be useful if Mr. Thorp could give an idea of the test which was employed for the free carbon. This was a very tricky thing. Free carbon was something which could give a good deal of enlightenment in regard to the tar.

Mr. T. B. Smith (Stocksbridge) said, in regard to the suggestion of prejudice on the part of steel firms, as one who was attached to a steel-works he could fully appreciate the fact that there was some prejudice; but the position was not entirely due to prejudice. Steel workers often found difficulty in using coke from the patent ovens because of its shape, which rendered it not so suitable for the crucibles as the needle-shaped bee-hive oven coke. There were substantial mechanical difficulties at present holding back the development of low-temperature carbonization. They had to get the smokeless fuel out of the oven at its maximum expansion; and it could not be quenched in the ordinary way by direct dowsing with water, or it would become very friable. It had to be quenched indirectly through the conductivity of metal plates and exterior application of water. When quenched indirectly in this way, the dust formed was not more than 5 p.ct.; but if it were quenched direct with water, they could expect anything up to 40 p.ct. of dust. In regard to the tar acids from the low-temperature process, he quite agreed that there was no carbolic acid; but there was 20 to 25 p.ct. of cresylic acids. Another point was in regard to avoiding the ammonia loss in the tanks. It was years ago since the method of putting a layer of light creosote on the tanks was used. It was not mentioned in the paper; but he had himself used it quite successfully. He could not agree with the view of Mr. Irwin that naphtha was better than creosote. At his (Mr. Smith's) plant, they had the direct process, with the result that the circulating oil increased in volume instead of decreasing, as in the indirect plant, due to the naphtha condensed from the gas. He found that by extracting the naphtha from the oil by partial fractionization and running the naphtha into a storage tank, instead of returning it to the circulating oil, they obtained better results. He noticed that where the naphtha was returned, the strength of the benzol was considerably reduced.

The Chairman remarked that he believed it was a common experi-

ence that if they made a change of oil they would always find that the quality of the benzol was lower for a day or so after the change.

Mr. GEO. CHRISP (Silverwood) said he had a few observations to make on the paper; but it might help a little in better understanding if Mr. Thorp would state exactly what the figures of yield stood for in his table.

Mr. THORP: Gallons per ton of tar.

Mr. CHRISP: The loss in distillation seems rather high.

Mr. THORP: They are laboratory figures, and they are not always absolutely reliable.

Mr. J. W. LEE (Hasland) said there was one very vital matter which was entirely omitted from the paper. This was that coals did vary. Some were quite suitable for gas-works practice but totally unsuitable for coke-oven practice, and some were quite unsuitable for either practice, but would be good for use in the low-temperature carbonization system. The whole question depended largely on the class of coal. There was much coal in the country which could not be carbonized in coke-oven plants, some which could not be carbonized in horizontal retorts, and some which was no good in vertical retorts. He did think it was possible that in the future, when the mechanical problems had been solved, a great quantity of coal would be carbonized under the low-temperature system. The disposal of the product of this method was not simple; and before they would convert the great bulk of the people of this country to the use of smokeless fuel there would have to be something in the nature of a great revolution in ideas. The question of carbonization was a very big one. What they had heard that afternoon, it seemed to him, was just a skimming on the surface of a very vast subject. The way in which the coal supplies of the country were going to be utilized in the future was a question which would have to be dealt with very largely indeed from a national standpoint. Whether it was all going to be dealt with at the pit-head, or whether the product was going to be distributed through trunk mains, or whatever else might be done, was a matter which they, in the coking industry, would have to watch closely. But whatever the method, to be done advantageously it would have to be done in a national manner. They had had that afternoon a contribution which should help them, in some little measure, towards this end.

Mr. THORP, replying to the discussion, said that, on the question of friability, Mr. Smith had had more direct experience than himself of this matter; and his dealing with it had been a sufficient reply. As to the pure carbon test, it was well known to be a difficult one. He had given up the thimble test long ago, and he really thought that by taking 10 grains of tar, 50 c.c. of benzene, 50 c.c. of solvent naphtha, and 25 c.c. of glacial acetic acid, using the decantation method as much as possible, and applying filter papers and drying in the oven, was the most reliable method he knew. He would not, however, say that even this was absolutely sure. If they used the wash bottle, they would wash the pure carbon through. He had thought that some members might have been able to give what they considered the highest yield of benzol. He considered it would be found generally that the higher the heats on the coke-oven the higher the yields of benzol. As regarded the use of naphtha, mentioned by Mr. Smith, the best answer was that Mr. Irwin had recovered three gallons of finished product per ton; and he did it on a large scale. At the same time, he (Mr. Thorp) agreed that a fair amount of anthracene and creosote was the best oil. As to changing oil, he found the test did go down; and he was rather a believer in changing oil as often as possible. In regard to Mr. Lee's remark that the paper omitted to mention the variation of coals, he would point out that the paper specifically stated coking coal. He was dealing only with this, and not with any class of (say) steel coals. As to the prospects of the use of smokeless fuel, in a district like Barnsley, at any rate, the experience had been that ordinary gas-works coke had had to be largely used even in the best class of houses, and in the future, with the increased cost of transport, &c., he thought the industry would probably have to go in for making a smokeless fuel at the pit top to compensate for these developments of cost, and utilize the 20 or 30 p.ct. of the products nearer home as the gas for the generation of electricity or similar purposes.

Mr. C. P. FINN (Hemsworth), in moving a vote of thanks to Mr. Thorp, said in regard to the use of bee-hive coke, he did not think the author was strictly correct in his view of the matter, because he (Mr. Finn) considered there were actually very few furnace plants using bee-hive coke now, unless they were some of the older type. If he had said steel melters, he would have been nearer the mark. His firm had, for a long time past, supplied special coke for steel melting in crucibles; and he knew that there was a preference among certain melting undertakings for bee-hive coke. It was largely due to the high quality of some of the bee-hive product, which was certainly better than the majority of patent cokes. In bee-hive coke with only 4 or 5 p.ct. of ash and a low percentage of sulphur, they had a very good coke; and when one wanted to satisfy the melters who were genuinely out to try to utilize patent coke, one had to supply material which was low both in ash and sulphur. In crucible steel melting, very valuable products were being handled; and if there was anything in the way of fusion, they got clinkering and breakage of pots and loss of valuable materials. The texture of patent coke, especially if it had been made by stamping, was too dense for most steel melters. Some years ago his firm made several varieties of the same type of coke, with about 4 or 5 p.ct. of ash and about 8 or 9 p.ct. of sulphur. Some people preferred a coke overhead charged instead of stamped—it was more open, more porous. It worked very well in their furnaces. On the other hand, it was strange that other people, with similar plants, preferred more dense coke. He had made personal investigations, and at one place he was told that when they had something hard to melt they wanted a load of "niggers"—stamped compressor changed patent coke; but for ordinary working they preferred the lighter variety. He found that where the steel melting was left in the hands of a scientific man the firms examined and tried the various cokes without bias, and many of them were able to use the patent coke. To-day his Company supplied a lot of patent coke to firms who were neighbours of others of the same kind who said they could not do with it. He had seen melts tried with both compressor coke and overhead-charged coke, and unquestionably the latter worked better in the furnaces. With care, however, selecting the coal and selecting the coke for texture, he felt that patent oven coke could be used for steel melting. It was well to remember this, because there were people who were trying to keep alive the prejudice in favour of bee-hive oven coke; and it was not in the national interest that bee-hive production should be retained any longer than could be avoided. He would suggest that Mr. Thorp might, in a future paper, give some valuable information concerning tars from different sources. There was 20-year old literature on tar; and a comparison of tar produced to-day in the coking plant, as against that produced in gas-works and other plant and that of former times, would be very useful. He had listened with great interest to the extracts from Mr. Irwin's letters. It seemed to be largely a case, as so often occurred, of the man to whom the greatest honour for investigation was due getting nothing like the credit to which he was entitled. The industry owed much to Mr. Irwin's early work; and he should be granted the fullest possible credit.

Mr. SMITH, in seconding the vote of thanks, said he was personally grateful to Mr. Thorp for bringing forward the subject of low-temperature carbonization. Although the system could not compete with high-temperature practice in the coke-oven industry, as regarded blast-furnaces they had a very serious competitor in the production of town's gas. The coke-oven managers should certainly know more about low-temperature carbonization than they did at present, because they would have to seriously compete with it in the future, when the few mechanical difficulties had been overcome.

Mr. THORP, in response, said perhaps at some future time he might be able to give more tests of tar. As regards low-temperature tars, it must be understood that he had not put down any tests in connection with the plant worked at Barugh. His observations were general. He thought the general features—the high percentage of tar acids, low percentage of free carbon, low percentage of pitch, &c.—applied pretty nearly all round.

### THE NEXT MEETING.

The CHAIRMAN announced that the next gathering of the Section will be a visit, on May 31, to the coking and bye-product plant of Messrs. Fox & Co., Stocksbridge, under the guidance of Mr. Smith.

## LIQUID FUEL BURNERS.

### Messrs. Field and Kirby's Patents.

The "Iron and Coal Trades Review," in a recent issue, gave an account of some trials with the above-named burners. They have courteously placed their article at our disposal, together with the illustrations they used.

The South Metropolitan Gas Company have, our contemporary points out, been burning liquid fuel for a number of years, more or less intermittently. So far back as 1907 Messrs. S. S. Field and A. Kirby acquired patent rights for a liquid-fuel burner; but as the selling prices of pitch and oils almost immediately took an upward tendency, these burners were never seriously exploited. Recently, however, firing with liquid fuel has rightly received more serious consideration.

The burners [see p. 250] were designed by Mr. Kirby for burning 50 p.ct. mixtures. The burners themselves call for little explanation. Fig. 1 is the burner specially designed for firing Lancashire boilers—a type fitted at the Ordnance Wharf. The boilers were 30 ft. by 7 ft. 6 in.; and the fuel consumption was 32 gallons of 50 p.ct. mixture per hour. The following results were recorded:

*Test on No. 1 Boiler, using "50/50" as Fuel, on Natural Draught.*

*Trial during three hours (2.30 p.m. to 5.30 p.m.).*

| | |
|---|---|
| Feed-water temperature | 54° Fahr. |
| Total water evaporated | 9684 lbs. |
| ,, oil fired | 889·35 lbs. |
| Oil per burner per hour | 14·1 gallons |
| Evaporation per pound of oil with feed water at 54° Fahr. | 10·88 lbs. |
| Evaporation per pound of oil from and at 212° Fahr. | 12·83 lbs. |
| Average pressure of steam | 34·14 lbs. |

*Test on No. 1 Boiler, using Pitch as Fuel, on Natural Draught.*

*Trial during four hours (11 a.m. to 3 p.m.).*

| | |
|---|---|
| Feed-water temperature | 54° Fahr. |
| Total water evaporated | 12,374 lbs. |
| ,, pitch fired | 1354·03 lbs. |
| Pitch per burner per hour | 13·4 gallons. |
| Evaporation per pound of pitch with feed water at 54° Fahr. | 9·13 lbs. |
| Evaporation per pound of pitch from and at 212° Fahr.. | 10·78 lbs. |
| Average pressure of steam | 31·77 lbs. |
| Steam pressure on burner: Minimum, 84 lbs.; average, 92·9 lbs. | maximum, 106 lbs.; |

*Test on No. 2 Boiler, using Good Clean Coke as Fuel, on Natural Draught, with Damper Wide Open.*

*Trial during four hours (10.10 a.m. to 2.10 p.m.).*

| | |
|---|---|
| Feed-water temperature | 53° Fahr. |
| Total water evaporated | 8608 lbs. |
| ,, coke fired | 1764 lbs. |
| Coke per furnace per hour | 220·5 lbs. |
| Evaporation per pound of coke with feed water at 54° Fahr. | 4·87 lbs. |
| Evaporation per pound of coke from and at 212° Fahr.. | 5·8 lbs. |
| Average pressure of steam | 49·77 lbs. |

The liquid fuel is contained in a tank above the boiler, which

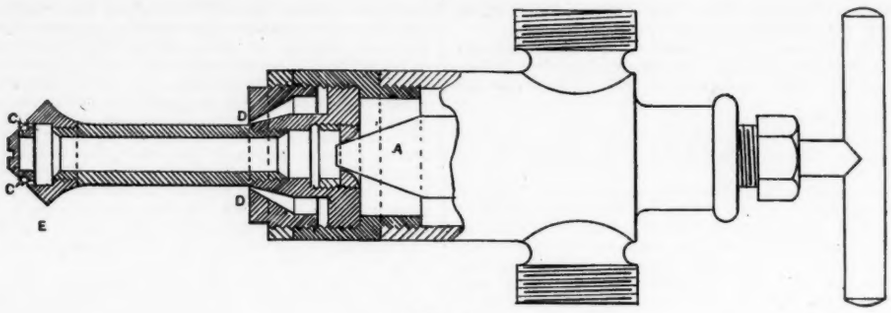



Fig. 1.

is heated by a steam-coil; the fuel gravitating to the feed in the burner, which is controlled by a screw-down valve. The steam circulates completely round the burner A, sucking through the fuel, which impinges upon, and discharges through, the rectangular passages C. Outlets for the steam are also furnished at D—the steam travelling along to the point E, where it meets and mixes with the ejected fuel, spraying out much in the same manner as a gas-burner.

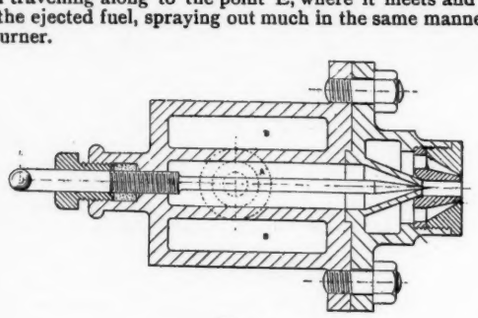


Fig. 2.

Fig. 2 shows the burner particularly designed for using pure pitch; the fuel chamber being shown at A, and the steam jacket and auxiliary supply at B.

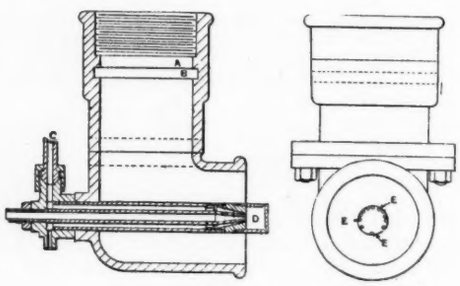


Fig. 3.

Fig. 3 shows a low-pressure burner of which Messrs. Young, Stephenson, and Kirby are joint patentees. This, while more particularly designed for furnace work, is also wholly satisfactory for firing boilers—in fact, for heating purposes generally. It is also claimed to be especially suitable for firing marine boilers owing to the following advantages: (1) Low air-pressure is used without steam; (2) the boiler can be started-up from cold on liquid fuel by having the air-fan driven from accumulators; (3) the only parts required in addition to the burner are a fan and a feed tank.

This burner was seen at the Wandsworth works of the Projectile Company (1902), Ltd., where it is fitted to some twenty-eight billet-heating furnaces, as also to one Lancashire boiler, on which last exhaustive evaporation tests have been made. The essential feature of this burner lies in the fact that only air is used in connection with its operation. Each boiler has its separate electrically driven fan, which furnishes a tank (in an elevated position) fitted with suitable strainers. The air-feed passes down the pipe A, and is controlled by the shuttle-valve B. The fuel, entering at the point C, mixes with the air in the chamber D, from which it is sprayed through a number of openings E into the furnace. The burner proper is installed a full 3 in. clear of the outside of the brickwork. This is important, as, should it be necesary at any time to shut-off the fuel supply, the burner is not subject to the destructive effects of the internal heat of the furnace. The air is preheated by passing the feed-pipe in the brickwork above the arch of the furnace. A second burner is installed on the opposite side of the furnace, the normal function of which is an auxiliary air-supply—the burner proper merely acting as a stand by to the one in service.

As evidence of its efficiency, one of the burners is working on a furnace 10 ft. by 5 ft. 6 in. by 3 ft. 6 in., which has an output of thirty 6½-in. billets (each weighing 160 lbs.) per hour, with a fuel consumption of 15 gallons of 50 p.ct. mixture, which is approximately 7½ gallons per ton, or 0·04 ton of fuel. This compares very favourably with the figures recently published by Sir R. Hadfield, who found that 0·08 ton of coal is required for heating one ton of steel to 900° C. The boiler fitted with the burner is one of a battery each 27 ft. by 7 ft. 9 in. The appended official trial speaks for itself:

*Boiler Trial, Nov. 2, 1918.*

No. 6, fitted with two burners and brickwork baffles in flues.

| | |
|---|---|
| Trial, 9 a.m. to 12 noon | Feed, 212° Fahr. |
| Total water evaporated | 18,437 lbs. |
| ,, oil used | 1204 lbs. |
| Evaporation per pound of oil | 15·3 lbs. |
| Oil used per burner | 17 gallons per hour |
| Trial, 1.15 p.m. to 4.15 p.m. | Cold feed, 54° Fahr. |
| Total water evaporated | 18,437 lbs. |
| ,, oil used | 1736 lbs. |
| Evaporation per pound of oil | 10·6 lbs. |
| Oil used per burner | 24·5 gallons per hour |

## NOTES ON REFRACTORIES.

The following are a few selected notes from a course of lectures ecently delivered at Newcastle-on-Tyne by Dr. J. W. Mellor.

In dealing with a fresh clay as a proposed refractory, the first thing is to find out if the clay is really refractory enough to be worth following up; and, secondly, if not refractory, the question arises: Can it be converted into a refractory by a cheap enough method of purification? The refractory test is so much more quickly and cheaply made than an analysis that it should come before an analysis, since with poor materials an analysis may not be worth while.

In devising a reliable test for the squatting temperature, it is necessary to decide what particular stage in a gradual process of softening shall be considered as the softening (or squatting) temperature; and it is also necessary to determine at what rate the temperature of the furnace shall be allowed to rise. If every man is at liberty to arbitrarily fix his own standards, it prevents a satisfactory comparison of results with those ot others. Consequently, the Refractory Materials Committee of the Institution of Gas Engineers and the Refractory Materials Section of the Ceramic Society have recommended that the refractory tests be made under certain specified conditions. Refractory tests of fireclays are made with cones as temperature indicators. The clay is moulded to approximately the same shape as the cone, dried, and mounted on a slab made from a mixture of equal parts of alumina and fire-clay, by means of a paste made from the same mixture. The clay cone is surrounded by a series of seger cones covering the range within which the clay squats. The slab with the cones on it is placed in an electric furnace, and heated at the specified rate until the specimen squats. The piece is then removed from the furnace and chilled. The temperature corresponding with the cone which was squatting, along with the specimen, is regarded as the squatting temperature of the clay. Dr. Mellor has used electric furnaces for this test for eight or nine years. He has found them very satisfactory, and is surprised at the bad reports others give of their unsatisfactory working.

Assuming that the refractory test is satisfactory, an ultimate analysis is desirable. This gives valuable information, if conducted properly; but some extraordinary analyses are met with at times. Objections are sometimes made that analyses are not of much practical value. Objections can only mean that the objector does not know how to use the information which is conveyed by analysis, and therefore assumes no one else does.

In the so-called system of rational analysis, an attempt is made to represent the composition of a clay in terms of the three components—ideal clay, quartz, and felspathic or micaceous matters. If this could be done with refractory clays, the results would be of much greater importance than the ultimate analysis, because the information would be less general and more specific, and therefore more useful. The methods devised for conducting this rational analysis are unfortunately based on general assumptions, which have been proved to be erroneous. The alternative plan of calculating the proximate composition from the ultimate

analysis generally gives better results than those obtained by actually performing the rational analysis.

Clays which have not been washed—and very few fire-clays are washed—have a grain-size which is determined largely by the non-clay constituents. A well-weathered clay seems to have its particles separated from one another by films of water. Under ordinary circumstances, the hard clays are ground; and the particles are never individualized, so to speak, but remain in lumps whose size is determined by the nature of the grinding. These lumps (technically called knaps) are clots or aggregates of the finer grains of clay. Their subsequent behaviour in the brick is like badly-fired grog. When a clay mixed with water is allowed to stand for a few weeks while wet, the knaps are being gradually broken-down by the water. Clays so prepared are usually easily moulded and worked; but they do not dry very well. It is difficult to dry plastic clays within a reasonable time. A non-plastic opening material is therefore added, usually grog; and the grain size of this is important. Fine-grained silicious materials added to clay tend to lower the refractoriness; and to avoid this result, some makers riddle-out the dust. In some cases, the mixture is afterwards put on an edge runner pan, which exerts a grinding action, so that fine-grained silica makes its appearance in the mixture after all.

When clay is heated with gradually rising temperature, it first gives off water by loss of hygroscopic moisture and dehydration of colloidal silicic acid. At 500° C., the clay is decomposed into free silica, free alumina, and water; at about 800°, the alumina begins to polymerize, forming more complex molecules; above 1000°, alumina and silica recombine to form sillimanite ($Al_2O_3 \cdot Sil_2$); at 1500°, the clay sinters to a stone-like mass; at 1650°, the clay softens and loses its shape; and at 1700° C., it forms a brown or grey viscid liquid. Some assume that the compound $Al_2O_3 \cdot 2Sil_2$ is formed in the second stage; but the only evidence of this is that the analytical ratio $Al_2O_3 \cdot Sil_2$ is the same before and after dehydration, which would be the case whether the alumina and silica were combined or free. Bricks while being fired or burned are at about 500° C. absorbing heat without becoming hotter, and at about 900°, they become hotter than the kiln, and afterwards cool down to the kiln temperature. The specific gravity of clay when heated falls from 2·61 to 2·47 at 600° C., and rises to 2·73 after calcination at 1200°.

A practical test for finding if a brick has been adequately fired is to heat one-half of a brick in a furnace in which it is to be used, and subsequently compare the result with the half which has not been re-fired. In the standard test, the brick is heated for a specified time at a specified temperature, and condemned if the residual or after-contraction exceeds the specified minimum. The effect of the gas engineers' specification on commercial bricks has been to lower the average after-contraction from about 2 to ¾ p.ct. Alumina, when heated, increases in specific gravity from about 2·8 at 600° to 3·9 at 1200° C., which corresponds with a contraction of nearly 30 p.ct. The change is accompanied by evolution of heat. The excessive contraction of bauxite or alumina is difficult to deal with—the products being liable to become cracked and distorted; and it is difficult to ensure completion of the reaction. Owing to such difficulties, alumina or bauxite bricks have not had a fair chance.

Some curious results were reported with regard to penetration of fire-bricks by dusts. With oxides of iron, copper, and zinc dusts in a reducing atmosphere, penetration is fairly rapid and fairly deep—perhaps an inch in two hours. There was some evidence of volatilization of the three metals at surprisingly low temperatures in reducing atmospheres—copper at 600° C., and iron at 1100°. These metals appear to penetrate the refractory as vapours; and a fine-grained texture offers the strongest resistance to penetration, as in the case of other dusts. Ferruginous dusts in reducing atmospheres are characterized by rapid slagging action. This was illustrated by reference to fire-clay retorts, heated by producer gas, and from the bottoms of which slag was steadily dripping—the result of the action of ferruginous flue dust (from the coal) on the fire-clay.

With salty coals, salt vapour rapidly attacks silica and fire-clay refractories. The slag formed from salt vapour and clay is very fusible; and the reaction is used for salt-glazing drain-pipes, &c. As to composition, bricks with a molecular ratio alumina to silica less than 1 : 3·5 give the best results in resisting, one good resister containing 63 p.ct. of silica and 30 p.ct. of alumina.

There is an appreciable difference in the behaviour of the products obtained by mixing wet and dry grog with wet clay, and generally in favour of the grog soaked in water. The wet grog gets a better grip, so to speak, of the other materials. When clay slip is poured into a plaster mould, the mould absorbs water and leaves a film of clay on its surface; and if wet clay be dabbed on a dry slab of plaster, a film of dried clay is formed in contact with the plaster, and the clay drops off. If the plaster slab be wet, the piece of clay sticks fast, and no film is formed. The behaviour of wet and dry grog is probably very similar. Subsequently, this influences the tensile strength, the crushing strength, and the contraction of the brick—all in favour of soaked grog.

For withstanding abrupt changes of temperature, materials of a porous open texture are used, regard being had to the necessary toughness, as in gas-retorts, zinc retorts, muffles, muffle quarries, &c. Consideration of permeability to gases makes it very necessary to limit the porosity; and the low thermal conductivity of highly porous materials also renders a porous structure undesirable for low-temperature muffles and retorts. As regards the thermal conductivity of retorts and the like at high furnace temperatures, contrary to the general opinion, Dr. Mellor believes that a highly porous structure favours the conductivity of heat, and considers that the effect of radiation across the pore spaces, and also convection, are by no means negligible. An investigation with a view to settling the question experimentally was well in hand, but had to be suspended. It has now been resumed. The point is very important in heat engineering.

### Heat Conductivity of Porous Refractory Materials.

At the April meeting of the Ceramic Society, held at Stoke-on-Trent, a contribution by Dr. Mellor was entitled the "Heat Conductivity of Porous Materials and the Heat Insulation of Kilns." It was explained that this was only introductory to a subsequent paper by Messrs. Edwards and Rigby, on "Conductivity of Fire-Bricks." In a lecture delivered in 1914, Dr. Mellor questioned the accuracy of the general belief that a porous structure favoured insulating properties at high temperatures, though there seems no reason for doubt in the case of comparatively low temperatures. It is a matter of comparing the heat that travels by conduction through solid matter, and the heat radiated across the air spaces. It was calculated that, assuming the diameter of the pores to be $\frac{1}{10}$ cm. (about the width of point of a "J" pen), at a temperature of 1400° C., the amount of heat carried across the air space and through the solid material is the same. With smaller pores, the temperature would be higher. Thus for pores $\frac{1}{100}$ cm. across, the temperature would be 3000° C.; but this could not be fairly regarded as a high degree of porosity. With pores ¼ cm. across, the corresponding temperature would be about 730° C., above which temperature the insulating properties begin to break-down. In these calculations, the conductivity of air and the change of conductivity with rise of temperature are ignored, as well as convection currents in the air. The actual temperature of the breaking-down of the insulating properties of porous refractory materials is thus within the limits of ordinary kiln temperatures. In order to apply experimental tests, bricks having different porosities, &c., were prepared with three longitudinal holes of different lengths in each. Thermocouples were inserted into these holes.

## Reinforced Concrete Liquor Tanks.

Some details of large storage tanks constructed in reinforced concrete for ammoniacal liquor were given in a paper contributed by Mr. F. W. Frerichs to the proceedings of the American Institute of Chemical Engineers. On account of the war, steel plates were not obtainable; and concrete was the next best thing available. By preliminary experiments, it was proved that good concrete was not materially affected by crude ammoniacal liquor; and in order to ascertain the permeability of concrete walls by water and aqua-ammonia, four small experimental tanks were constructed and tested. The evaporation was measured; and subsequently the tanks were dried-out and painted on the inside with three coats of raw gas tar. The tar used for the first coat was thinned-down with about 10 p.ct. of turpentine, which caused the tar to penetrate about ⅛ in. into the concrete. After a week's drying, the tanks were tested again with ammoniacal liquor, and during several months there was no appreciable loss of their contents. Encouraged by these results, three large storage tanks were built in a concrete pit, 47 ft. wide, 130 ft. long, and 30 ft. deep. The three tanks are 35 ft. inside diameter, and 26 ft. deep. The walls are 7 in. thick; and the tops are covered with a concrete roof, 6 in. thick. The manholes in the top are sealed, to prevent the escape of gases; and the entire roof can also be covered with water, as an additional seal against the escape of gases through the concrete. The capacity of each tank is about 185,000 gallons.

## Advertising Section of the American Gas Association.

It has already been stated in the "Journal" that, at the recent New York conference of the American Gas Association, it was unanimously agreed to establish an advertising and publicity section. Some of the reasons for adopting this course were set forth, in a paper which he read on the occasion, by Mr. Milt Saul, who pointed out that the gas business is a highly technical one, and requires special education and training for those who conduct it. It is therefore logical to assume that some education must be provided and distributed among prospective customers, before anything approaching an understanding on the part of the general public can be realized. When the Advertising and Publicity Section (which will be in the nature of a central publicity bureau for the gas industry of the United States) is established, it will be possible from this source to provide all the elements of a thorough education of the public on the subject of the gas business. Furthermore, it will be possible to bring into the sphere of this section's activities those individual gas companies who have been in the past struggling along without adequate means for informing their communities of the character and advantages of gas service. Every gas company should inaugurate and maintain an adequate advertising department. In approaching the formation of the section referred to, Mr. Saul says one very essential idea should be kept in mind. It must be assumed that the entire gas industry is a unit, similar in its operations to an individual gas company; for it is the industry as a whole which must create the section, and which must maintain it and receive whatever advantages may accrue from it.

# REGISTER OF PATENTS.

## Pistons and Piston Rings.—No. 121,632.

Spencer, J. A., of Southall.

No. 18,888; Dec. 20, 1917. No. 2389; Feb. 9, 1918.

This invention (relating to pistons and piston rings for internal-combustion engines, steam-engines, pumps, and the like) consists of a packing of the type in which an expander or follower is acted upon by elastic pressure to expand the packing more or less against the liner, or piston (or both) and of a method of lubricating the parts in frictional contact. By these means it is claimed that there is no loss during compression, and during the power stroke the joint remains perfectly tight with an easy working of the parts moving in frictional contact.

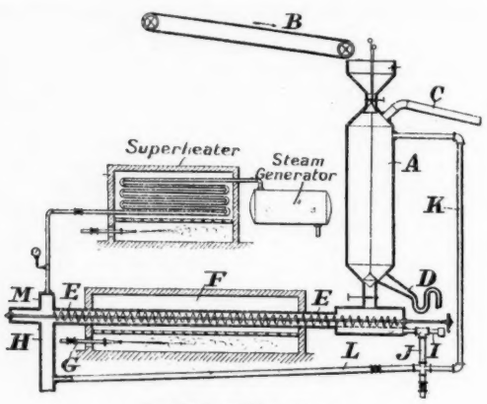
The inventor combines hard metal rings of a conical or taper section (serving as packing, and mounted upon the piston or the like) with a particular construction of loose head or cap abutting and putting end-pressure upon the rings so as to expand or contract them by a spring or springs, or by the expanding fluid (or both) acting upon the head or collar or upon the piston. The packing rings are also severed, or have a saw-cut on one side running in an oblique direction in order to allow them to be expansible or contractible when pressure is applied. The rings are also so arranged that the cut in one ring does not come opposite that in an adjacent ring, and grub screws prevent the saw-cuts of any two rings subsequently getting into line.

## Extraction of Hydrocarbon Products from Shales and Coals.—No. 123,415.

Day, D. T., of Washington, U.S.A.

No. 3521; Feb. 27, 1918.

One feature of this invention pertains to the combined extraction of the products by solvent action and destructive distillation; while a further feature includes the use of vapours derived from the shale by destructive distillation as a "novel solvent" for the volatile matter present in such shale or coal.




**Day's Distillation Plant.**

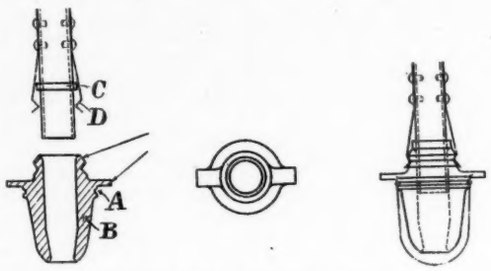
An elevation is given of suitable apparatus in which to execute the process. A is an extraction chamber in which fresh cold shale is subjected to the solvent action of vapours. Above the chamber is a hopper arranged to receive shale or coal brought by a conveyer B. Closures are provided at the top and bottom of the chamber A for limiting the passage of shale into and out of a chamber, and also for preventing the escape of the solvent vapours from the chamber while the shale is being treated. At the top of the chamber is a conduit C to provide a passageway for the discharge of gases to a condenser and scrubber (not shown). Adjacent the base of the chamber A is a conduit D for leading the extracted liquids and condensed vapours to a tank for storage. At the base of the chamber A provision is made for the discharge of the shale into an inclined tubular retort E (with a screw-conveyer) provided with a heating device or furnace F, which obtains its source of fuel by a gas-heater G. The discharge passage for the spent shale is at H. At the opposite end from the passage H, and somewhat nearer the chamber A, the tube E is provided with a discharge passage I for the vapours extracted from the shale. These vapours are carried into a passageway J, from which they are conducted as vapours to the top of the chamber A by the conduit K. Heavy matters (such as tar) liberated in the tube E are trapped at the bottom of J and led to a receiving tank. An optional treatment is provided by the conduit L through which the heavy tars may be delivered for cracking by the hot spent shale discharged through H. Connected to the system, as indicated at M, is an inlet passage for superheated steam, for use if it is desirable to employ steam in the extraction process.

## Incandescent Burners.—No. 123,561.

Anderson, W. J., of South Tottenham.

No. 3061; Feb. 21, 1918.

The mantle-holder for inverted incandescent burners here referred to consists of a solid ring made of non-inflammable material (to which the mantle is attached) with a tube projecting upwards for fixing on to the burner mouth, and a tube projecting downwards inside the fabric to within a given distance from the bottom, so as to ensure that the gas-flame comes into contact with the bottom of the fabric first, before it rises outside the tube, but inside the fabric until it passes out at the top—"thus securing the complete combustion and also a considerable saving of gas."




**Anderson's Incandescent Gas-Burner.**

The illustration shows the burner mouth and a sectional elevation of the mantle holder, also the mantle and mantle holder secured on the burner mouth, and a plan of the holder.

The mantle holder is made of refractory material, and is formed with the usual groove A, in which the edge of the mantle is secured. Above the groove the holder is solid, and is formed as a tubular extension adapted to be placed over, and secured on, the burner mouth. Below the groove, the holder is formed as a tubular extension B, which extends downwards within the mantle for the greater part of its depth, so that the burning gas is caused to pass entirely through the mantle and be completely consumed, as already described. The holder is also formed with lugs to facilitate handling. The holder, with the mantle on it, is passed over the burner mouth up to the collar C (which serves to prevent any escape of gas), and is there secured by the spring fingers D.

## Carbonizing or Distillation Apparatus.—No 124,015.

Freeman, N. H., of Chesham.

No. 2462; Feb. 12, 1918.

This invention relates to apparatus in which the material under treatment is passed in a zig-zag manner through a series of superposed compartments by means of stirrers or scrapers, and in which each compartment is heated separately in a controllable manner. In the usual circular retort (consisting of a chamber provided with a number of plates placed above each other and mounted alternately on a central revolving shaft and on the casing) the material admitted on to the uppermost revolving plate is gradually scraped from it by deflecting plates hinged to the cover of the chamber and allowed to fall on to the next lower fixed plate, from which it is scraped or deflected by scrapers attached to the lower side of the revolving plate and permitted to fall on to the next lower revolving plate, and so on through the chamber.

According to the present invention, each successive carbonizing or distilling chamber is provided with a centrally disposed rotary platform for receiving the coal, over which platform the material, when entering the chamber, is caused to move in one direction by stationary shoes or deflectors, while similar shoes or deflectors carried by the platform on the opposite side feed the material in the reverse direction to the outlet of the chamber. The chambers are so constructed and arranged as to afford an independent annular heating chamber between each pair of adjoining carbonizing chambers, and means are provided to enable the gaseous products of distillation to be led away separately from each chamber.

The means for controlling the temperature is of the type in which a body of mercury is caused to close an electrical circuit and so reduce the temperature, as described in patent No. 120,590.

## Recovering Benzol and Other Useful Products from Acid Tars.—No. 124,605.

Thorp, F. & H. T., of Whitefield, Lancs.

No. 6306; April 13, 1918.

This invention (relating to the recovery of benzol and other hydrocarbons) has for its object to provide for the effective treatment of the waste acid tar obtained during the refining with sulphuric acid of benzol, toluol, solvent naphtha, and other coal-tar oils, and for obtaining benzol, toluol, solvent naphtha, benzoic acid, and their homologues. During the refining, the hydrocarbons are washed with sulphuric acid, which removes impurities, and in so doing becomes a black viscous liquid (waste acid tar) "with offensive smell and strongly corrosive, rendering it difficult to dispose of or to treat for the recovery of its acid and other contents."

This waste acid tar is heated, in a covered still or vessel, to a temperature of from 80° to 250° C. in the presence of steam, either superheated or not, and under a pressure equal to, or less than, atmospheric. By this treatment, there are obtained by distillation the volatile components of the waste acid tar—such as benzol, toluol, solvent naphtha, benzoic acid, and their homologues—which are already present or formed during the treatment; while by ordinary methods of fractional distillation, the distillates may be obtained more or less separate from each other. Subsequent purification is effected in any ordinary manner. The residue of the still is a solid carbonaceous mass with some dilute sulphuric acid.

The patentees say they have found that if the waste acid tars are taken from the washers in which they are produced direct into water,

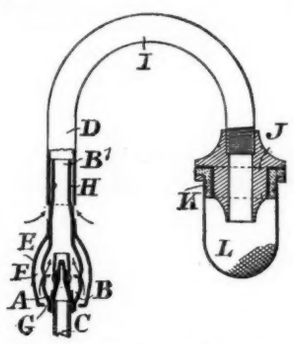
or are treated with water before the distillation referred to, it is possible to recover resinous substances in a practically pure condition. If they are not so recovered, they may be destroyed in the distillation process by heat and sulphuric acid. They accordingly propose to pass the waste acid tar into water, which may be equal in amount to, or from one-half to the same volume as, the acid tar, and thoroughly mix by agitation. On allowing the mixture to stand, the resinous substances separate as a pasty mass from the acid which collects beneath it. The acid is then removed in any ordinary manner; and the pasty mass is thoroughly washed with water before it is transferred to a still for steam distillation. At the end of the steam distillation, the residue, consisting of resinous substances, is withdrawn to a filter, wherein it is washed and freed from acid and other impurities. To remove the last trace of acid, a little ammonia or other alkali may be added to the washing water.

### Incandescent Gas-Burners.—No. 123,107.

Schroeder, F. W., of Kennington Road, S.E.

No. 12,293 of 1917; Feb. 14, 1918.

This invention relates to inverted incandescent gas-burners in which the radiated heat is utilized to preheat the mixture of gas and air before it strikes the mantle, and wherein the mixing of the gas and air is effected in stages.




**Schroeder's Incandescent Gas-Burner.**

As shown, a portion of the air necessary for combustion mixes with the gas as the latter (issuing from the gas supply pipe C) enters the bunsen tube A in a mixing chamber B. A further quantity of air mixes with the first lot as the latter comes from the mouth of the bunsen tube, and a still further quantity is added as the mixture issues at the mouth of the mixing-chamber B and enters a mixing tube D. The final mixture of gas and air passes from the tube D along a bent tube or arm I, either formed separately from, or as an extension of, the mixing-tube D, to the burner nozzle piece J.

The terminal portion of the mixing-chamber in proximity to the bunsen tube is enclosed in a chamber F formed by a casing E, which, at its upper end, is attached to the upper end of the mixing-chamber B, and at its lower end is formed so as to leave an annular passage G (between it and chamber B), through which the air for mixing with the gas enters the chamber F. The remaining portion of air may be admitted by passages H formed by indenting or corrugating the wall of the reduced upper portion of the mixing chamber. The nozzle-piece J is, as compared with known burner nozzle-pieces, of massive form, and is of conical shape at its lower or exit end, and cylindrical at its other or admission end. The mantle holder is formed with lugs which engage, in bayonet-like fashion, with the lugs on the burner nozzle. In this way the nozzle-piece, on becoming heated, thoroughly heats the mixture of gas and air passing from the tube I.

## APPLICATIONS FOR PATENTS.

**[Extracted from the "Official List" for April 24.]**

Nos. 9403—9911.

Belton, F. W. J.—"Air or gas heating-apparatus." No. 9598.
Couch, C. A.—"Devices for gas mixing or carburetting." No. 9761.
Grainger, J. E.—"Manufacture of ammonium sulphate." No. 9784.
Helps, G.—"Joints of main-pipes." No. 9415.
Ionides, A. C.—"Heating-appliances." No. 9880.
Jefferies, W.—"Combination gas kitchen range or stove." No. 9789.
Keesing, H. M.—"Gas and water regulating-means of water-heaters." No. 9614.
Pease, E. L.—"Subdivision and treatment of fluids." No. 9467.
Rock, W. D.—"Extracting hydrocarbons from coal, &c." No. 9686.
Shadbolt, S. M.—See Grainger. No. 9784.
Shand, J.—"Gas cooking-rings." No. 9731.
Smith, C. H.—"Furnace retorts." Nos. 9768, 9819.
Stafford, O. F.—"Process of destructive distillation." No. 9491.
Towl, A. Pearce.—See Shand. No. 9731.
Wilkinson, G.—"Electrically-operated valves for control of steam, gas, air, liquids, &c." No. 9671.

**Reduction in Price at Sunderland.**—The Sunderland Gas Company announce a reduction in the price of gas of 4d. per 1000 c.ft., bringing the charge down to 2s. 3d., less discount.

# MISCELLANEOUS NEWS.

## POISONING OF FISH BY ROAD WASHINGS.

In response to an inquiry by the Editor of the "Fishing Gazette" as to what are the poisons which are washed into rivers from tarred roads, Mr. W. J. A. Butterfield, M.A., F.I.C., deals fully with the subject in an article which appeared in the issue of that publication dated the 5th inst.

The question, it is pointed out, is one which does not admit of a very simple answer. Crude tar contains ammonia, which is highly poisonous to fish; but such tar is less efficient for road dressing than dehydrated tar, and is now rarely applied to road surfaces. The greater part of the ammonia and ammoniacal compounds in crude coal tar, being highly volatile, would pass into the atmosphere within a day or two of the spraying of the tar on the road; and thereafter the tarred surface would not pollute road washings to any appreciably greater degree than a surface originally treated with dehydrated tar. It is likely, however, that some cases of poisoning of fish within a day or two of the dressing of the road with tar have been caused or aggravated by the employment of crude coal tar. Cases in which crude tar has been instrumental must have occurred chiefly in the early years of road tarring, as the bulk of road tarring in recent years has been done with tar which is dehydrated to conform to the requirements in this respect of the Road Board's specifications for tar for road use. Owners of fishing waters can quite properly, in Mr. Butterfield's opinion, veto the use of crude coal tar on roads in the neighbourhood of their waters.

With regard to the more usual treatment of roads with dehydrated tar, as approved by the Road Board, Mr. Butterfield says the constituents of such tar which are most directly injurious to fish are the phenols—that is, carbolic acid, cresylic acid, &c. These bodies ordinarily form from 0·5 to 4 p.ct. by weight of dehydrated coal tar; the proportion varying according to the manufacturing conditions. Water dissolves from 15 to 30 p.ct. of phenols when mixed with them alone. But the oily and bituminous constituents in tar are retentive of phenol; and it seems impossible by agitating coal-tar with water to impart much more than 25 parts of phenols to 100,000 parts of the water (=25 lbs. of phenols per 10,000 gallons). Such a proportion will kill most fish in 15 to 30 minutes; and dilution with something approaching one hundred times as much water is probably necessary to avoid altogether risk of injury to fish-life. The Road Board allow a maximum of 3 p.ct. of phenols in coal tar for road use* (thus excluding the more highly phenolic tars). Hence 1 gallon of road tar (sp. gr. 1·2) might conceivably, by thorough extraction with water, pollute something approaching 14,400 gallons of water to an extent sufficient to bring it on the verge of being dangerous to fish-life. A gallon of tar dresses, in round figures, 50 sq. ft. of previously untarred surface; and if the road is tarred for a width of 25 ft., 2640 gallons of tar are used per mile of road dressed. That is to say, the tar on every mile stretch of tarred roadway, might conceivably pollute something approaching (in round figures) 38 million gallons of water. This volume of water would be contained in about 23 miles of river, 25 ft. wide, with a mean depth of 2 ft., or in 4·8 miles of river 60 ft. wide, with a mean depth of 4 ft.

Dehydrated road tar is a viscous material, which runs or pours freely only when hot. In thin layers, as on tarred fences or road surfaces, it gradually hardens or sets, partly through the volatilization of some of its components, and partly through oxidation of other components. But even when newly spread, and still more when set, it repels water, and is consequently extensively used for waterproofing boards, felt, millboard, &c., for various commercial uses; and it is largely in virtue of its waterproofing qualities that it forms a useful road-dressing material. It is obvious that if tar is a waterproofing material it must be virtually impermeable to water; and this being so, any action of rain water on a tarred surface must be restricted to the surface or skin, and cannot extend to the interior of the layer or coating of tar. The surface of the tar, properly speaking, has area without depth; and the weight of tar in it is infinitely small. But since, in practice, a tarred surface will have inequalities or pittings, and its skin must be permeable to some insignificantly small depth, it will be reasonable to assume that a tarred surface is actually accessible to, or permeable by, water to a depth of (say) one-thousandth of an inch. Now, a gallon of tar spread over 50 sq. ft. of roadway gives a tar coating averaging one twenty-fifth of an inch in thickness. Consequently, only one-fortieth of the tar spread on a road may be regarded as accessible to, or permeable by, water at any given time. If we were to assume that the surface skin of tar were so miscible with water that the phenols, &c., were completely extracted by the latter, a mile stretch of tarred roadway might conceivably pollute—to the verge of being dangerous to fish-life—something approaching one million gallons of water, or as much as is contained in rather over half-a-mile of river 25 ft. wide, with a mean depth of 2 ft. But by no method of agitation, prolonged contact, or otherwise, known to Mr. Butterfield, is it possible to transfer to water (pure and simple) the whole of the phenols contained in tar. The tar retains the bulk of its original content of phenols after each treatment with water.

By vigorous and prolonged agitation of fresh tar with water, about 25 parts of phenols may be taken up by 100,000 parts of water. This strength is attained when about twenty volumes of water are used to one volume of tar. Consequently the skin of a tarred road surface, representing one-fortieth of a gallon of tar to 50 sq. ft., may impart to $\frac{2640 \times 20}{40}$ = 1320 gallons of water, this degree of phenol pollution for every mile of roadway tarred to a width of 25 ft. This volume of

* **The majority of several hundred samples of road tar which have passed through the writer's laboratory in the last few years actually have contained less than 1 p.ct. of phenols.**

water is equivalent to 1 gallon per 100 sq. ft. of road surface, or a rainfall of rather less than one-fiftieth of an inch. If the proportion of water to tar is increased, the phenolic strength of the extract is, according to Mr. Butterfield's tests, reduced correspondingly; so that a rainfall of one-tenth of an inch would yield, per mile of tarred roadway 25 ft. wide, 6600 gallons of water containing at the most five parts of phenols per 100,000, or a rainfall of half-an-inch 33,000 gallons of water containing at the most one part of phenols per 100,000. Even the latter water, if undiluted, would be unsafe for fish; but a dilution to four times its volume, reducing its phenolic content to 0·25 part per 100,000, would, so far as experiments show, render it quite safe.

It therefore appears that the tar on a properly tarred road surface should not *per se* pollute road washings to an extent to render them injurious to fish life, provided that for every mile of roadway (tarred over a width of 25 ft.), there is discharged with the washings at least 132,000 gallons of water, or that there is already in the stream into which the washings flow at least this volume of water. This volume of water would be contained in a mile of river 4 ft. wide, with a mean depth of 1 ft. That is to say, if a tarred road ran for some miles alongside a river of less than this minimum summer volume, and the whole of the road washings drained direct into the river, the river would in all probability be unsafe for fish life. If the river is of greater than this minimum summer volume, it should be safe, provided it is not polluted from other sources as well. Obviously some pollution from other sources can hardly anywhere be excluded; but, on the other hand, no river will run for many miles without receiving additional water from tributaries and springs, some at least of which will be unpolluted by road washings. With a river which is polluted by sewage, or otherwise, to the verge of being unsafe for fish life, clearly no additional pollution through inflow of washings from tarred road surfaces is safe; and there can be little doubt that with waters which otherwise are of dubious quality a comparatively small inflow of tarred road washings has sufficed to turn the scale, and fish have not been able to survive the slight increase in pollution. The tarred road, as the new comer, is held responsible for mischief to which it may be only a minor contributor.

Herein, no doubt, lies the explanation of discrepancies which have been reported between the results of laboratory experiments on tar and other poisons, and the observed effects of the same poisons in rivers, &c. The laboratory experiments are made with water which is sufficiently pure for drinking; and the effect on fish is that of the added poison only, whereas most river water, &c., is more or less polluted, and the effect, when poison is added, is that of the added poison supplemented by the initial river pollution.

After having set out, as he says, the worst which road tar, properly applied, can, in the light of his knowledge of it, do to fish life in rivers near the tarred road, Mr. Butterfield goes on to remark that the times when a tarred road is likely to be most dangerous to fish life are: (1) When the tarring is quite fresh, and is followed by heavy rainfall which lifts some of the tar before it has set or hardened; and (2) when the coating of tar is broken-up through age and wear and tear, so that rain will permeate freely through the severed particles of spent tar. This condition occurs to some extent in the dust which forms on a tarred road after prolonged drought, but in the most aggravated form when a tarred surface or a tarred macadam road is scarified before re-making.

The first of these two sets of conditions cannot be absolutely avoided. But the chances of its occurrence may be greatly reduced by reserving tarring operations in the vicinity of fishing waters to periods of settled weather; and the risks attaching to it may be minimized by using only a specially heavy grade of tar which becomes thick and viscous on cooling immediately after application, by sanding or gritting the coating at once and rather heavily, and by forming catch-pits which will retain tar floated off the road by rain. This risk is restricted to one or two days after tarring, or even less if a highly viscous tar is used and applied in a very hot, and therefore fluid, condition.

The second of the two sets of conditions does not normally arise if the tar coating is renewed or refreshed as soon as disintegration or breaking-up sets in. While old or spent tar coatings will impart to water only about one-third as much phenols as will fresh tar, they are physically in a condition for ready permeability by rain water (the waterproofing quality of the tar having largely disappeared); and hence there is greater certainty of the extraction of phenols from them by rain water, though the theoretical maximum extraction for fresh tar is never attained. Experiments made in collaboration with Mr. F. G. Richmond a few years ago have convinced Mr. Butterfield that a broken-up tarred road surface may be extremely dangerous to fish; and when material is removed from a tarred road preparatory to re-making, care should be taken that it is not left lying where rain washings from it will enter fishing waters.

The only widely applicable alternative to tar is an asphaltic bitumen. Such material is commonly free from phenols or other soluble poisonous ingredients. Asphaltic bitumen is, however, all imported, is more expensive than tar, and needs greater skill in its employment and application. Properly prepared coal-tar, a product of home industry, gives very good results at comparatively low cost, even in the hands of unskilled labour. It would, in Mr. Butterfield's opinion, be necessary to show that there are no reasonable means by which the use of tar on roads can be safeguarded before its use could be prohibited in favour of asphaltic bitumen, in the interests of the purity of our lakes and rivers. The question is largely one of the extent to which tarred roads contribute to the general pollution, and how their contribution can be reduced to a negligible value.

There seems to Mr. Butterfield to be no reason why road washings should not be regarded in their proper light as sewage, and treated accordingly. He says that in many cases controlled irrigation of arable land, as in a sewage farm, would afford the best means of disposing of, and purifying, road washings. Phenolic compounds have been used for the sterilization of soil, with resultant increase in fertility, and would therefore be beneficial rather than otherwise to the land. Oil stands in a different category; but since some sort of collecting tanks or reservoirs would generally be necessary in order to control the flow to the land, the oil film could be retained there or in roadside pits by means of scum-traps.

As regards the purification of road washings in bacterial beds, it is known that phenol in dilute solution is oxidized therein, even when it occurs in the waste liquor from ammonia stills, which contains also thiocyanate and other compounds which hinder bacterial activity. With road washings containing much organic matter, the oxidation or destruction of the phenols would be relatively rapid and complete. In some cases, it would no doubt be convenient to use the same system for the treatment of domestic sewage from roadside dwellings.

Phenols are the chief and best-defined toxic ingredients of coal tar; and there is no doubt that a synthetized tar, made by dissolving soft pitch in tar oils from which phenolic bodies have been extracted by chemicals, would be less toxic than ordinary road tar. The use of such a synthetized coal tar in exceptional cases was suggested by Mr. Butterfield in 1912; but he is not aware that it has been actually prepared and used with the object of reducing risk of injury to fish life. Some few samples of tar which have passed through his hands for analysis seem likely, however, to have been prepared in this way, probably because it paid the distiller in particular circumstances to extract the phenols for their own value. While the potentiality for mischief is greatly reduced in such tar, Mr. Butterfield regrets that he cannot say its use in place of ordinary road tar would entirely remove all risk of injury to fish life. It must be remembered that the more dangerous grades of tar are already precluded by the Road Board specifications.

There are methods for the treatment of tar—mostly patented or proprietary—which no doubt bring it nearer to asphaltic bitumen in innocuousness; but one, at least, of the most promising of them in this respect destroys much of the valuable characteristics of tar from the road-making standpoint. Mr. Butterfield believes that no special treatment of tar for the removal of its poisonous properties can in the long run give as good results as the collection and treatment as sewage of all road washings. But such treatment should go hand in hand with other measures for preventing pollution of our watercourses.

## MANCHESTER CORPORATION GAS UNDERTAKING.

### Consumption of Gas and Financial Results for the Past Year.

At last Wednesday's meeting of the Manchester Corporation a report by the Superintendent of the Gas Department (Mr. Fred A. Price) was presented, showing that during the year ending March 31 the output of gas was 5862 million c.ft., as compared with 6049 millions for the year ending March 31, 1918, or a decrease of 3·09 p.ct. There was a decrease of 1·41 p.ct. in the day consumption (from 8 a.m. to 6 p.m.) and of 4·92 p.ct. in the night consumption (from 6 p.m. to 8 a.m.). The smaller decrease in the daytime was due to the use of cookers and fires and to the extended use of gas-furnaces for industrial purposes.

Mr. Price pointed out that the Household Fuel and Lighting Order came into operation, in regard to gas, as from the 29th of September, 1918, and the restrictions were relaxed to the extent of 25 p.ct. from the meter readings for the December quarter. The effect on the consumption of gas was as follows:

| | Decrease. | Per Cent. |
|---|---|---|
| October-December, 1918 | 206,096,000 c.ft. | 11·23 |
| January-March, 1919 | 17,711,000 ,, | 1·02 |
| For the six months | 223,807,000 c.ft. | 6·25 |

The reduction in the output of gas caused by the Household Fuel and Lighting Order was estimated at 8¼ p.ct. for the six months October to March, as it was reasonable to assume that an increase of at least 2 p.ct. would have been shown but for the effects of the Order. This amount was included in the estimated loss of output. The effect of the Order is to be seen in the reduction of over 3 p.ct. in the annual output of gas, instead of an increase of 2 p.ct., which would otherwise have accrued. This represents about 300 million cubic feet, or 5 p.ct., and is equal to 25,000 tons of coal.

Notwithstanding labour and other difficulties there has been during the year an increase of 4669 heating appliances fixed, as follows:

| | |
|---|---|
| Cookers | 2,782 |
| Grillers | 109 |
| Fires | 1,800 |

The total number of gas consuming devices in use at March 31 was:

| | |
|---|---|
| Cookers | 94,851 |
| Grillers | 38,741 |
| Fires | 28,031 |
| Other appliances | 69 |
| Total | 161,692 |

There was an increase of 365 consumers with ordinary meters and of 1142 with automatic meters, making a total increase of 1507. The total number of consumers at March 31 was 197,074, of whom 81,929 used gas through automatic meters.

#### Financial Results.

The year was commenced with a balance in the reserve fund of £49,043.

The income for the year was estimated at £1,161,000 and yielded £1,223,411 or £62,411 more than estimated, which is analyzed as follows:

| | | |
|---|---|---|
| From Gas* | £40,864 | more than estimated. |
| ,, Coke | 36,138 | ditto. |
| ,, Tar | 6,573 | ditto. |
| ,, Sundries | 146 | ditto. |
| | £83,721 | |
| From concentrated ammonia, sulphuric acid, and toluol | 21,310 | less than estimated. |
| | £62,411 | |

* Principally owing to the advance of 4d. in price, which took effect from September 29, 1918.

Immediately after the signing of the armistice the Government instructed the works to cease concentrating ammonia and to revert to

the manufacture of sulphate, and also to suspend supplies of toluol and benzol. They are now manufacturing and selling sulphate of ammonia under licence at the Government controlled prices.

The estimated expenditure for the year was £1,132,722; and the actual amount expended was £1,145,247, or £12,525 more—a very fair estimate, having regard to the advances in wages under trade arrangements, and various awards of the Committee on Production, the extent of which could not, of course, be accurately gauged when the estimates were prepared.

The full effect of all these awards will be felt in the coming year, the estimates for which were submitted—showing, after entirely depleting the reserve fund, an adverse balance of £65,871. The increases of wages in the department granted during the year are estimated to cost £49,055 per annum. The total increase over pre-war wages will then be £156,135 per annum.

Mr. Price suggests that consideration of ways and means to meet the anticipated deficit should be deferred until the workmen's hours question is settled and the annual balance-sheet is presented. He reminds the Committee that neighbouring undertakings have recently made advances of 8d. and 10d. in the price of gas; but he hopes it will not be found necessary to advance the price of gas in Manchester to any such extent—if at all.

## AUSTRALIAN GAS UNDERTAKINGS.

### Some Reports and Accounts.

The Directors of the Australian Gas Light Company, in their report for the half year ended Dec. 31, state that the profits, after making the necessary provision as prescribed by the Gas Act, and including £11,500 brought forward, amounted to £102,080. This was sufficient to pay a dividend for the six months of 4½ p.ct. on the "A," "B," and "C" shares (making 8 p.ct. for the year), and leave £33,230 to be carried forward. As from Feb. 1, the price of gas was reduced 1d. per 1000 c.ft., making the charge 4s. 4d. Arrangements had been made for the sale by auction of 50,000 new shares of £6 each.

The accounts of the Melbourne Metropolitan Gas Company for the same period showed a net profit of £107,029, as compared with £86,026 a year ago. The dividend was at the usual rate of 6s. 6d. per share; and the Board asked for authority to issue 8558 new shares and debentures for £42,790.

The balance-sheet of the North Shore (Sydney) Gas Company showed that the profit for the year ended Dec. 31, after allowing for bad debts and interest, and setting aside an amount for the special purposes and depreciation fund, and including the unappropriated balance of £2043 from last year, amounted to £50,635. The interim dividend at the rate of 3½ p.ct. on the "A" and "B" shares required £18,398, leaving a balance to the credit of the profit and loss account of £32,236. Out of this amount, the Directors recommended the payment of a dividend for the half year ended December at the rate of 4½ p.ct. on the "A" and "B" shares, making 8 p.ct. for the year. The balance carried forward to the next account was £8581. The Directors pointed out that, in view of the urgent necessity for extension, it had been resolved to increase the capital by the issue of 25,000 £1 shares. As from Feb. 1, the price of gas was reduced 1d. per 1000 c.ft.

The Maryborough (Queensland) Gas and Coke Company, Ltd., made a profit for the last half of the past year (after making provision for further State and Federal taxation, repairs and renewals, depreciation, working expenses, bad debts, and all other charges, and including the balance brought forward) amounting to £1261, from which the Directors recommended the payment of the usual dividend of 6 p.ct. per annum, free of income-tax.

The operations of the Maitland Gaslight Company, Ltd., for the half year ended Dec. 31 resulted in a net profit of £1241, which compared with £1187 for the preceding six months, and £984 for the corresponding period in 1917. The sum of £278 having been brought into account, £1519 was available for a dividend at the usual rate of 6 p.ct. per annum, needing £1046, and leaving a balance of £473 to be carried forward.

The Directors of the Brighton (Victoria) Gas Company, for the same six months, decided to pay a dividend at the rate of 7 p.ct. per annum. For the corresponding half of the previous year the dividend was at the rate of 6 p.ct. per annum.

The half-yearly report of the City of Newcastle (N.S.W.) Gas Company recorded a profit of £9820; and dividends were recommended at the rate of 7 p.ct. per annum on the "A" and "B" shares, and £4 18s. on the "C" shares, absorbing £9535. This left a balance of £284 to be added to the sum of £4370 brought forward. The Government have decided to refund the Company income-tax which has been in dispute for the past seven years. At the meeting, Mr. E. A. M. Merewether (who presided in the absence of the Chairman) stated that negotiations were proceeding for the taking-over of the Waratah gas undertaking. The many problems in connection with works extensions, scientific treatment of residuals, &c., had called for the appointment of consultants in both the engineering and chemical branches; and in regard to the former, satisfactory arrangements had been made with Mr. P. C. Holmes Hunt.

**Armadale Gas Company, Ltd.**—To supply gas in Armadale, the parish of Bathgate, and neighbourhood, a private company has been registered, with a capital of £20,000 in £1 shares. The address of the Company is No. 175, West George Street, Glasgow.

**Gas-Works Reconstruction at Denton.**—The Denton Gas Committee have decided on the expenditure of £30,000 for the purpose of reconstructing the gas-works. Mr. W. Buckley, of the Manchester Corporation Gas Department, who has been advising the Denton Gas Committee in the matter, states that the works are in need of complete rebuilding.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## CURRENT SALES OF GAS PRODUCTS.

### Tar Products in the Provinces.

*April 28.*

The average values for gas-works products during the week were: Gas-works coal tar, 34s. 6d. to 39s. 6d. Pitch, East Coast, 51s. 6d. to 52s. 6d. per ton f.a.s.; West Coast—Manchester 44s. to 45s.; Liverpool, 45s. to 46s., Clyde, 46s. to 50s. nominal. Benzol 90 p.ct., North, 1s. 9d. to 1s. 11d.; crude, at 120, 65 p.ct., 1s. 1d. to 1s. 2d.; 50-90 p.ct., naked, North, 1s. 9d. to 1s. 10d. Toluol, naked, North, 2s. to 2s. 1d. nominal. Coal tar crude naphtha in bulk North, 8d. to 8½d. Solvent naphtha, naked, North, 2s. to 2s. 2d. Heavy naphtha, North, 2s. 7d. to 2s. 8d. Creosote, in bulk, North, salty, 4½d. to 5d.; ordinary liquid, 5d. to 5½d. Heavy oils, in bulk, North, 6d. to 6½d. Carbolic acid, 60 p.ct., unsaleable. Naphthalene, £18 to £23; salt, £6 to £7, bags included. Anthracene "A" quality, 6d. to 7d. per minimum 40 p.ct.; "B" quality, 2d. nominal.

## FROM A MARKET CORRESPONDENT.

### Tar Products.

Over the holidays trade has been slack, and the resumption of activity is perhaps hardly to be expected immediately. The condition of affairs generally last week has been quiet. Pitch remains firm enough at late rates, although but few transactions are reported from the Provinces. The looked-for demand for road work does not come along as was hoped; but probably this is merely a matter of waiting for more propitious weather. Benzol is moving off very freely, and the demand for home uses is extending in several directions. The trade is, somewhat anxiously, discussing Budget prospects. The future position of petroleum spirits is obscure; but it is generally believed that it will be 1s. per gallon, and that benzol will be free. At the same time it is well to remember that a very large revenue has to be raised; and it is quite possible that benzol, as a motor spirit, may be included in the schedule for taxation. Toluol is without special feature. Refined naphthalene is lower again, and even a further decline is not unlikely. Crude continues about the same. Solvent naphtha shows no definite price change, although the feeling is weak, and business could probably be done at less than the quoted rates. Grease oils are dearer. Creosote is in good demand without any alteration in values; but carbolic acid continues lifeless, and there is no indication of any improvement being likely for some time to come. No business is being done, and prices are nominal. Cresylic acid is unchanged. Other products call for no special comment this week.

The French markets have improved slightly since last mentioned, although transactions are not yet very important. Imports from America have been rather larger, while business with Great Britain is about the usual level; the present high rates of exchange preventing many buyers from completing orders. The manufacture of coal-tar dyes is progressing; ordinary colours being produced in fairly large quantities

The range of home quotations is as follows:

Benzol: 90% London 2s. to 2s. 2d., North 1s. 11d. to 2s.; 50-90% 1s. 9d. to 2s. London, 1s. 9½d. North; crude 60-65% 1s. 6½d. to 1s. 7½d.; pure, 2s. 6d. per gallon naked.

Carbolic Acid: Crude 60's unsaleable; crystals, 40%, 4d. per lb. asked.

Crude Tar: London, 40s. to 41s.; Midlands, 34s. to 36s.; North 35s. per ton *ex* works.

Pitch: London, 65s. to 70s. per ton; East Coast, 49s. to 52s. per ton; West Coast, 45s. to 47s., with Manchester 45s. 6d. per ton and Glasgow 47s. 6d. per ton; South Wales, 56s. to 58s. per ton.

Solvent Naphtha: London, 2s. 2d. to 2s. 6d. Provinces average 2s. 3d. per gallon.

Crude Naphtha: Naked, 10d. per gallon.

Heavy Naphtha: 2s. 6d. per gallon.

Naphthalene: Refined, £19 to £20 per ton nominal; crude, £5 10s. to £10, according to quality.

Toluol: Naked, 2s. 1d. to 2s. 3d. per gallon nominal.

Creosote: London, 7⅞d.; North, 6¾d. to 7d.; heavy oil, 7¼d. per gallon in bulk.

Anthracene: 40-45%, 4½d. to 8d. per unit per cwt.

Grease Oils: 18° Tw. (naked), £6 10s. per ton f.o.r. makers' works.

Aniline Oil: 1s. 2d. per lb.

Cresylic Acid: 95%, 2s. 9d. to 3s.; 97-99%, 3s. to 3s. 3d. *ex* works London; f.o.b. other ports.

### Sulphate of Ammonia.

Movements have been retarded by the holidays, and stocks show a disposition to rise; being assisted in this direction by foreign inquiries for coke. The fertilizer continues to move off steadily, and foreign business is better, although it is not of a voluminous character. Considerable interest is being taken in the future; but so far it is not at all clear what is going to happen after the opening of June. There was a lengthy meeting before the holidays, and I had hoped to have discussed the decisions last week; but up to time of writing a report of the proceedings has not been released for publication. I can state, however, that the Association has been authorized to proceed. The position at the moment is fraught with difficulty, and requires careful handling. The home supply must be safeguarded to start with. When control is removed and subsidies disappear, manufacturers will be free to make higher charges for home consumption; and they will probably do so, because it would appear that export business would be more profitable. The question then arises: Will the farmer pay, or will he return to nitrate of soda, which, as I showed last week, may quite likely fall to its pre-war level? As regards foreign business, it is impossible to say what prices will be available, as competition to be met in our pre-war markets is practically an unknown quantity at present.

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The position in America is still good; and there is no disposition on the part of sellers to solicit business at less than recently quoted rates. The American Government have apparently decided to maintain nitrate of soda prices, and consequently the steady undertone in sulphate of ammonia is likely to continue. At the same time it is worth noting that during 1918 there were completed, and placed in operation, in North America (including Canada and the United States) no fewer than 2445 bye-product coking-ovens; making a total of 9940 at work at the end of the year. In addition, there are now under construction 14 new plants, with a total of 1620 ovens, which will be completed this year. The result is that, for the first time in the history of the industry, there will be more coke produced in America and Canada this year in bye-product coking-ovens than in bee-hive ovens. These figures go far to prove my nearly two-year-old contention that North America would cease to be a buyer of British sulphate of ammonia, and would become an active competitor in our near-by pre-war markets. Already America can offer her sulphate at the equivalent of about £22 to £23 per ton f.o.b. Hence it must be obvious that the old export prices of from £28 to £33 cannot long be maintained—probably £18 to £20 is the limit to be expected; and if the home farmer returns to nitrate of soda, it may be much less than this.

**Woodall-Duckham Retorts for Brechin.**—The Brechin Gas-Works are to have expended on them £12,000 for alterations and developments. These include an installation of vertical retorts by the Woodall-Duckham Company. Everything will be done to push forward the work, and bring the plant and arrangements up to date.

**Stove Hire Charges at Smethwick.**—Owing to increased expenses in connection with the Smethwick Gas Department, the Council have agreed to an increased hiring charge for stoves of 6d. per quarter. If the old charge was 9d. per quarter, the new rate will be 1s. 3d. The majority of the stoves, however, were hired at 1s. per quarter; so that the increase in this case amounts to 50 p.ct.

**Sunderland Corporation and the Gas Undertaking.**—The Directors of the Sunderland Gas Company were last Thursday given power to negotiate with the local Corporation if the latter body decide to purchase the undertaking. The Company's Bill now before Parliament was amended by the insertion of a clause suspending the operation of the Act until twelve months after its passing, so that the Corporation might purchase.

**Gas-Fire Fatality at Clerkenwell.**—At an inquest on the body of a little girl just under two years of age, the daughter of a Clerkenwell labourer, who died as the result of burns, it was stated that the baby was left by the mother with two other young children, in a room where there was a lighted gas-ring. It is supposed that the victim's clothing, comprising flannelette garments, came in contact with the flame. Inspector Coleman called attention to the fact that the Children Act, which enacted that there should be a guard to an open firegrate where there were children under the age of seven, did not cover gas-fires. The Coroner said that, considering the large number of fatalities which he himself had investigated caused by gas-fires, he thought they ought to be included in the Act.

**Oil and Natural Gas Fires.**—It is stated by Mr. C. P. Bowie, of the United States Bureau of Mines, that during the period of ten years from Jan. 1, 1908, to Jan. 1, 1918, approximately 12,850,000 barrels of oil and 5,024,506,000 c.ft. of natural gas were destroyed by fire in the United States, entailing a total estimated property loss of $25,254,200. The losses from the fires caused by lightning were estimated to be $11,148,000, and from those due to all other causes $14,106,200. Directly and indirectly, the fires resulted in the deaths of nearly 150 persons, and were responsible for almost as many more being permanently disabled. For the past three years, the United States Bureau of Mines have been conducting investigations to determine the nature and the specific causes of these fires, with a view to suggesting means whereby they may be successfully combated.

**Gas-Works Results at Rotherham.**—Mr. J. S. Naylor, the Engineer and Manager of the Rotherham Corporation Gas Department, in his report for the year ended March 31, states that the amount of gross profit made was £10,809, as against £14,061 last year, or a decrease of £3252. The net profit, after allowing for interest, redemption instalments, and contributions to sinking funds was £871, as against £4189, a decrease of £3318. If the gas for public lighting (£387) was given by the department, as in former years, there remained a surplus of £483, as against £3882 a year ago, or a decrease of £3399. The cost of coal carbonized was 23s. 4·75d. per ton, as compared with 18s. 8·60d. per ton a year ago. Though there was a decrease of 1636 tons used, the total increased cost was £4243. The gas made was less, due to the department having purchased nearly 24 million c.ft. of coke oven gas from Messrs. John Brown & Co. The quantity of gas sold showed a decline of 2,693,000 c.ft. The cost of public lighting in the borough, including wages and maintenance of lamps, amounted to £2585, as against £1354.

**Local Authorities' Loans and Treasury Control.**—A circular addressed to local authorities by the Local Government Board states that the Treasury have decided that the control exercised during the war by the Capital Issues Committee over the raising of new capital in the market need no longer be maintained, except as regards issues for capital purposes outside the United Kingdom. It will, therefore, no longer be necessary for local authorities to obtain the sanction of the Treasury for capital expenditure; and local authorities who had obtained the Board's sanction to loans before March 12, 1915, do not now require any further sanction to enable them to raise the loans. The Treasury propose to issue a public notice that borrowing powers granted under Private Bill Legislation during the war subject to the restriction that the assent of the Treasury must be obtained for any borrowing in the war period may, until further notice, be exercised without Treasury sanction beyond that given in the notice. In view of the relaxation of all control over capital issues by local authorities, the Treasury regard it as essential that loans should only be advanced from the Local Loans Fund to authorities with a rateable value not exceeding £200,000, except in particular cases which are specified.


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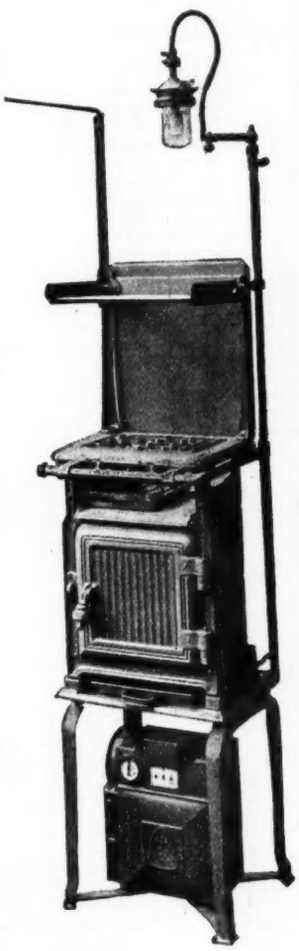

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**Increase of Price at Paisley and Port Glasgow.**—The price of gas has been increased at Paisley 3d. per 1000 c.ft., making the rate 4s. 2d. The Port Glasgow price has been raised 4d. per 1000 c.ft. The rates are now: Ordinary consumers, 4s. 8d.; prepayment meters, 5s. 2d.; and power, 4s. 5d. per 1000 c.ft.

**Increased Gas Profits at Blackpool.**—A record has been attained by the receipts of the Blackpool Corporation Gas Department for the past year; the amount being £150,357, or nearly £20,000 more than during the previous year. The working expenses, at £124,903, were about £1000 less than the estimate; while the receipts were £5000 more. There is a disposable balance of £10,326, as against an estimate of £4017. Interest and sinking fund absorbed £16,212. The "Blackpool Herald" remarks that the large profit recorded is a testimony to the excellent way in which the undertaking is conducted. The output of gas during the past financial year was 689,144,000 c.ft., a decrease of 0·8 p.ct.; the reduction being due to the operation of the Fuel Order and the lessened number of troops in the town. The capital outlay at the end of last month amounted to £245,130, with loans and sinking fund £146,660, reserve fund £25,511, development fund £314, and a working balance of £2500.

**Burnley Chamber of Trade and Gas Quality.**—The Burnley and District Chamber of Trade have addressed a memorial to the Local Government Board objecting to an Order being granted to the Corporation allowing them to increase the maximum price of gas, unless a clause is inserted compelling them to supply gas of a minimum calorific value of 550 B.Th.U. They remark that complaints are general with regard to the very poor heating qualities of the gas supplied. On Feb. 21, 1917, it was of 550 B.Th.U., while for March, 1919, it was 468 B.Th.U.

**Wallpapers and Gas Consumption.**—Writing in the "Daily Mail," Mr. George H. Holden states that London is the most extravagant city in the world as regards the annual consumption of gas; while Amsterdam, Berlin, New York, and Paris follow in the order given. Remarking that large gas bills and dark wallpapers are usually found together, he points out that, should a room papered with deep chocolate be re-papered with chrome yellow, it will be nearly three times as light with the same consumption of gas. It is strongly argued by scientists that, both for economy in artificial lighting and comfort in the daylight lighting of rooms, the ceilings should invariably be white, and the walls, if not white, should at least be of the palest shades.

## STOCK MARKET REPORT.

Last week the Stock Exchange had another short spell of four days within which to concentrate its energies (the House being closed on Easter Monday); but it was not able to raise the pressure and develop any increase of activity, and could only manage to put together a very moderate aggregate of business except in a few special lines. The tone also varied similarly in response to the nature of the circumstances affecting each case.

In the gilt-edged market, Home Government issues were well supported. The 5 p.ct. War Loan was in excellent demand, and progressed daily; marking 96$\frac{5}{16}$ frequently on Friday. The 4 p.ct. Loan, for income-tax reasons, was equally strong, and reached 102$\frac{1}{2}$. Bonds were firm. Home Rails were in very poor case, and dull from start to finish. Canadians began well, but fell back later. Argentines were unsteady.

In the Foreign Market, the most noteworthy feature was the revival of inquiry for Russians, in view of recent defeats of Bolshevik forces. Italians fell on the Fiume difficulty; but later they partially recovered. Japanese and Chilian were firm; but French gave way a little. In the Miscellaneous, there was an amount of profit-snatching which spoiled recent rises. Oils suffered here; but the looked like recovering at the close. Rubber and Breweries were irregular; but Nitrates were steady.

Business in the Gas Market was very quiet indeed—not even those undertakings which have lately been most prominently conspicuous before the public eye being able to furnish a moderate array of transactions, and the total aggregate being far below the average. However, the general tone did not appear to suffer from this lack of support, for prices throughout were fully abreast of the previous week's figures, and what few changes were made in quotations were for the better. In the Metropolitan and Suburban groups, there was no variation. Imperial Continental was rather firmer at from 131 to 134$\frac{3}{4}$, and the quotation was put up 1. In Primitivas, the ordinary shares touched 30s., and the quotation rose $\frac{1}{4}$. Cape Town changed hands at 4$\frac{1}{2}$; the quotation rising $\frac{1}{4}$. Local transactions in Derby ordinary at from 90 to 93, and in ditto debenture at from 75 to 76, are reported.

Bargains done for cash during the week were as follows: On Tuesday, Gas Light ordinary 62, 62$\frac{1}{2}$, 63, Imperial Continental 131, 132, 133, Primitiva 28s. 9d., 30s., ditto preference 50s., 51s., 51s. 3d., South Metropolitan 62$\frac{3}{4}$, 63, Wandsworth and Wimbledon "B" 70. On Wednesday, Cape Town ordinary 4$\frac{1}{4}$, Gas Light ordinary 62, 62$\frac{1}{2}$, 63, 63$\frac{3}{4}$, 64, 64$\frac{3}{4}$, Imperial Continental 132, 132$\frac{1}{2}$, 133, 133$\frac{3}{4}$, 134, 134$\frac{3}{4}$, Metropolitan of Melbourne 95$\frac{3}{4}$, Primitiva 29s., 30s., ditto preference 51s. 3d., South Metropolitan 62$\frac{3}{4}$, Gloucester 77, 77$\frac{1}{2}$. On Thursday, Gas Light ordinary 62$\frac{1}{2}$, 62$\frac{3}{4}$, 63, Imperial Continental 133$\frac{1}{2}$, 134, Oriental 104$\frac{1}{2}$, 105, Primitiva 29s. 29s. 6d., ditto preference 51s., 51s. 3d., 52s., South Metropolitan 62$\frac{1}{4}$, ditto preference 95$\frac{1}{2}$, South Suburban debenture 90, Hartlepool 5 p.ct. ordinary 84$\frac{3}{4}$, North Metropolitan 5 p.ct. preference 76$\frac{1}{2}$, 77. On Friday, Brentford preference 79, 79$\frac{1}{2}$, Chester 81$\frac{1}{4}$, Gas Light ordinary 63, 63$\frac{1}{4}$, 64$\frac{1}{2}$, 64$\frac{3}{4}$, ditto debenture 57$\frac{1}{4}$, Imperial Continental 133, 133$\frac{1}{2}$, 134$\frac{1}{2}$, 134$\frac{3}{4}$, Primitiva 27s. 6d., ditto preference 51s. 3d., South Metropolitan 62$\frac{3}{4}$.

In the Money Market, rates were firm in response to a good steady demand. The Bank rate is 5 p.ct., as fixed on April 5, 1917.

### ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

| Issue. £ | Share. | When ex-Dividend. | Ante-War Dividend & Bonus p.c. | Last Dividend. | NAME. | Closing Prices. July 30, 1914. | Present Prices. | Lowest and Highest Prices of Bargains. |
|---|---|---|---|---|---|---|---|---|
| 189,049 | Stk. | Mar. 10 | 4 | 4% | Aldershot 4 p.c. Pref. | .. | 62—67 | .. |
| 1,551,868 | " | April 8 | 2½ | 2⅞% | Alliance & Dublin Ord. | 59—64 | 48—50 | .. |
| 374,000 | " | July 10 | 4 | 4% | Do. 4 p.c. Deb. | 76—79 | 61—63 | .. |
| 280,000 | 5 | April 29 | 7½ | 8% | Bombay, Ltd. | 5⅞—6⅛ | 5⅜—6⅛ | .. |
| 50,000 | 10 | Feb. 26 | 16 | 12% | Bournemouth Gas and Water { 10 p.c. | 29—30 | 21—23 | .. |
| 388,110 | 10 | " | 7 | 7% | Bournemouth Gas and Water { B 7 p.c. | 15—15½ | 10—11 | .. |
| 115,000 | 10 | " | 6 | 6/- | Bournemouth Gas and Water { Pref. 6 p.c. | 13½—14 | 9—9½ | .. |
| 159,740 | — | — | — | 4% | Bournemouth Gas and Water { 4 p.c. Deb. | .. | 66—68 | .. |
| 999,045 | Stk. | Feb. 26 | 14 | 37/- | Brentford A Consolid. | 361—366 | 76—79 | .. |
| 784,990 | " | " | 11 | 31/8 | Do. B New | 204—209 | 70—75 | .. |
| 55,000 | " | " | 5 | 5% | Do. 5 p.c. Pref. | 109—111 | 78—83 | 79—79½ |
| 221,400 | " | June 11 | 4 | 4% | Do. 4 p.c. Deb. | 91—93 | 65—67 | .. |
| 217,880 | " | Feb. 26 | 11 | 7½% | Brighton & Hove Orig. | 208—218 | 137—142 | .. |
| 244,200 | " | " | 8 | 5⅓% | Do. A Ord. Stk. | 154—159 | 94—99 | .. |
| 933,500 | Stk. | — | 5 | 5% | Bristol 5 p.c. max. | .. | .. | .. |
| 580,000 | 20 | Mar. 26 | 12½ | 10% | British | 44—45 | 30½—31½ | .. |
| 120,000 | Stk. | June 26 | 4 | 4% | Do. 4 p.c. Deb. Stk. | 88—90 | 64—66 | .. |
| 245,771 | " | " | 4 | 4% | Buenos Aires 4 p.c. Deb. | 85—87 | 50—53 | .. |
| 100,000 | 10 | — | — | — | CapeTown & Dis., Ltd. | 1½—2½ | 4—4½ | 4½ |
| 100,000 | 10 | — | — | 4½% | Do. 4½ p.c. Pref. | 4—6 | 7½—8½ | .. |
| 100,000 | Stk. | June 26 | 4½ | 4½% | Do. 4½ p.c. Deb. Stk. | 70—75 | 60—65 | .. |
| 157,150 | " | Feb. 26 | 5 | 5% | Chester 5 p.c. Ord. | 108—110 | .. | 81⁷ |
| 1,518,280 | " | Feb. 12 | 5/9/4 | 30/- | Commercial 4 p.c. Stk. | 106—108 | 62—65 | .. |
| 560,000 | " | " | 5⅓ | 26/8 | Do. 3½ p.c. do. | 103—105 | 59—62 | .. |
| 475,000 | " | June 11 | 8 | 8% | Do. 3 p.c. Deb. Stk. | 69½—71½ | 51—53 | .. |
| 800,000 | " | " | 4 | — | Continental Union Ltd. | 76—79 | 48—53 | .. |
| 200,000 | " | " | 7 | — | Do. 7 p.c. Pref. | 115—118 | 70—75 | .. |
| 61,600 | Stk. | Aug. 29 | 14½ | 12½% | Croydon A 10 p.c. | .. | 155—165 | .. |
| 278,400 | — | " | 11½ | 9½% | Croydon B and C 7 p.c. | .. | 130—135 | .. |
| 499,270 | Stk. | " | 6 | 5⅛% | Derby Con. Stk. | 123—125 | .. | 90—98 |
| 65,000 | " | — | 4 | 4% | Do. Deb. Stk. | 102—104 | .. | 76—76 |
| 1,002,180 | 10 | July 29 | 10 | 5/0 | European, Ltd. | 17½—18 | 12½—13½ | .. |
| 16,298,975 | Stk. | Feb. 10 | 4/17/4 | 30/- | Gas Light and Coke { 4 p.c. Ord. | 98—102 | 62—64 | 62—63½ |
| 9,800,000 | " | " | 3½ | 26/8 | Gas Light and Coke { 3½ p.c. max. | 76—79 | 55—57 | .. |
| 4,062,287 | " | " | 4 | 4% | Gas Light and Coke { 4 p.c. Con. Pref. | 96—99 | 70—72 | .. |
| 4,874,850 | " | June 11 | 8 | 8% | Gas Light and Coke { 3 p.c. Con. Deb. | 72½—74½ | 56—58 | 57½ |
| 180,000 | " | " | 10 | 10% | Gas Light and Coke { 10 p.c. Bonds | .. | .. | .. |
| 82,500 | " | Mar. 12 | 5 | 4½% | Hastings & St. L. 5 p.c. | .. | 59—64 | .. |
| 358,740 | " | — | 5½ | 2⅞% | Do. 3½ p.c | 87—89 | 44—49 | .. |
| 70,000 | 10 | April 29 | 11 | 8% | Hongkong & China, Ltd. | 16½—16⅝ | 7½—8½ | .. |
| 86,600 | Stk. | Sept. 12 | 9 | 8½% | Hornsey 7 p.c. | .. | 115—120 | .. |
| 181,000 | " | Mar. 12 | 7½ | 6⅔% | Ilford A and C. | 151—154 | 90—95 | .. |
| 65,780 | " | " | 6⅔ | 4⅔% | Do. B | 115—118 | 69—74 | .. |
| 65,500 | " | June 26 | 4 | 4% | Do. 4 p.c. Deb. | 92—94 | 62—65 | .. |
| 4,940,000 | " | May 14 | 9 | 4½% | Imperial Continental | 150—160 | 131—136 | 131—134¾ |
| 1,286,000 | " | Feb. 12 | 3½ | 5⅓% | Do. 3½ p.c. Deb. Red. | 84—86 | 72—74 | .. |
| 285,242 | " | Mar. 12 | 6½ | 6½% | Lea Bridge Ord. 5 p.c. | 119—121 | 90—95 | .. |
| 2,498,908 | " | Feb. 26 | 10 | 42/6 | Liverpool 5 p.c. Ord. { A / B | 211—213 / 146—148 | .. | .. |
| 806,068 | " | June 26 | 4 | 4% | Do 4 p.c. Pr. Deb. Stk | .. | .. | .. |
| 165,786 | " | Feb. 17 | 7/5/6 | 8⅔% | Maidstone 5 p.c. | .. | 58—63 | .. |
| 75,000 | 5 | June 11 | 6 | 5% | Malta & Mediterranean | 4½—4⅝ | 3½—3⅔ | .. |
| 250,000 | 100 | April 1 | 4½ | 4½% | Met. of Melbourne { 4½ p.c. Deb. | 99—101 | 90—97 | 96½ |
| 641,950 | 20 | May 26 | 4 | 5/- | Monte Video, Ltd. | 11½—12 | 9⅜—9⅞ | .. |
| 1,875,899 | Stk. | July 29 | 4½ | 5⅓% | Newcastle&Gatsh'dCon | 98½—99½ | 70½—71½ | .. |
| 529,726 | " | June 26 | 5½ | 5⅓% | Do. 3½ p.c. Deb | 82—83 | 57—59 | .. |
| 55,940 | 10 | Feb. 26 | 7/14/- | 7½% | North Middlesex 7 p.c. | 14—15 | 9½—9⅔ | .. |
| 800,000 | Stk. | May 14 | 8 | 8% | Oriental, Ltd. | 117—122 | 103—106 | 104½—105 |
| 60,000 | 5 | Mar. 26 | 10 | 1/- | Ottoman, Ltd. | 7½—7⅞ | 4⅜—5⅛ | .. |
| 60,000 | 50 | Feb. 26 | 18 | 7⅛% | Portsea, Island B | 128—131 | 76—81 | .. |
| 100,000 | 50 | " | 12 | 6⅔% | Do. C | 118—121 | 58—63 | .. |
| 249,960 | 5 | April 29 | 8 | — | Primitiva Ord. | 5½—6 | 1½—1⅔ | 27/6—30/- |
| 499,960 | 5 | June 26 | 5 | — | Do. 5 p.c. Pref. | 4⅞—5 | 2½—2⅔ | 50/—52/- |
| 631,600 | 100 | June 9 | 4 | 4% | Do. 4 p.c. Deb. | 91—93 | 74—76 | .. |
| 600,000 | Stk. | July 31 | 4 | 4% | Do. " " 1911 | .. | 46—49 | .. |
| 946,198 | " | June 26 | 4 | 4% | River Plate 4 p.c. Deb. | 86—87 | 48—52 | .. |
| 150,000 | 10 | May 14 | 6 | 6/- | San Paulo { 6 p.c. Pref. | 10½—11 | 7½—8 | .. |
| 195,000 | 50 | June 1 | 5 | 5% | San Paulo { 5 p.c. Deb. | 47—49 | 40—42 | .. |
| 135,500 | Stk. | Mar. 12 | 10 | 5% | Sheffield A | 228—234 | 83—85 | .. |
| 909,984 | " | " | 10 | 5% | Do. B | 229—234 | 88—85 | .. |
| 528,800 | " | " | 10 | 4⅔% | Do. C | 220—222 | 82—84 | .. |
| 188,201 | Stk. | Sept. 12 | 4 | 4% | Shrewsbury 5 p.c. | .. | .. | .. |
| 90,000 | " | May 26 | 9 | 6/- | South African. | 10½—11½ | 13—14 | .. |
| 6,609,847 | Stk. | Feb. 10 | 5/4/0 | 30/- | South Met. 4 p.c. Ord. | 111—113 | 62—65 | 62½—63 |
| 950,000 | " | July 12 | — | 5% | Do. Pref. | .. | 95—97 | 95½ |
| 1,895,448 | " | July 10 | 8 | 8% | Do. 3 p.c. Deb. | 72½—74½ | 54—56 | .. |
| 294,220 | " | Feb. 26 | 5⅔ | 5% | South Shields Con. Stk. | 157—159 | 111—113 | .. |
| 952,795 | " | " | 6 | 3⅔% | S'th Suburb'n Ord. 5 p.c. | 114—116 | 76—79 | .. |
| 187,558 | Stk. | June 26 | 5 | 5% | Do. 5 p.c. Deb. Stk. | 116—118 | 89—92 | 90—91 |
| 647,740 | " | May 14 | 8 | 8% | Southampton Ord. | 99—102 | 69—71 | .. |
| 120,000 | " | Feb. 12 | 7½ | 4⅔% | Tottenham { A 5 p.c. | 135—138 | 90—95 | .. |
| 782,375 | " | " | 6 | 3⅔% | Tottenham { B 3½ p.c. | 115—117 | 65—67 | .. |
| 181,255 | " | June 26 | 4 | 4% | Tottenham { 4 p.c. Deb. | 87—89 | 64—66 | .. |
| 182,880 | 10 | Dec. 30 | 5 | — | Tuscan, Ltd. | 2—3 | 1—2 | .. |
| 149,900 | 10 | July 1 | 5 | 5% | Do. 5 p.c. Deb. Red. | 93—95 | 45—50 | .. |
| 286,476 | Stk. | Mar. 12 | 5 | 5% | Tynemouth 5 p.c. max. | 108½—109 | 83—85 | .. |
| 80,000 | " | Feb. 26 | 8⅔ | 5⅓% | Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c. | 151—156 | 88—93 | .. |
| 255,686 | " | " | 6⅔ | 40/- | Do. B 3½ p.c. | 129—134 | 68—73 | 70 |
| 108,075 | " | " | — | 38/6 | Do. C | .. | 68—73 | .. |
| 140,865 | " | " | — | 38/6 | New Ordinary | .. | 68—73 | .. |
| 852,000 | " | " | 6⅔ | 38/9 | Wimbledon 5 p.c. | 117—122 | 68—73 | .. |
| 98,000 | " | " | 6⅔ | 40/- | Epsom 5 p.c. | 121—126 | 70—75 | .. |
| 88,416 | " | June 26 | 8 | 8% | 3 p.c. Deb. Stk. | 68—69 | 50—52 | .. |

**Gas-Works and Benzol Production.**—A campaign against the present high prices of motor fuel was inaugurated by the Automobile Association with a largely-attended meeting at Maidstone. A resolution was unanimously adopted calling upon the Government to remove the super-tax on petrol, in accordance with the pledge given on June 22, 1917, and, further, to refrain from reimposing it in any form whatever. It was added: "This meeting further calls upon the Government to require all gas companies to oil-scrub their gas for benzol, and to grant every facility for the manufacture of alcohol for motor purposes."

"The Times" says that the Bremen gas workers having joined the general strike movement, the citizens have begun a general counter-strike.

An order has been received by Messrs. Bale and Hardy for one of Tully's carburetted hydrogen plants, 150,000 c.ft. per day capacity, to be erected at the Honley (near Huddersfield) Gas-Works.

Plans have been passed at Aberdeen for a considerable extension of railways at the Corporation gas-works. Additional storage will also be provided for coals. An outlay of £4000 or £5000 is being made.

In the face of considerable opposition by the Labour Party, various local officials under the Spenborough (Yorkshire) Urban District Council—including Cleckheaton, Gomersal, and Liversedge—were granted increases of salary last week. Mr. A. L. Jennings, the Gas Engineer, receives an increase of £63 15s. per annum.

Included in a long list of articles the exportation of which from Switzerland is now permitted under a general licence issued by the Swiss Department of Public Economy, are gas-meters and incandescent mantles.

A defective electric circuit last Tuesday at the House of Commons led to trouble in connection with the fuse-boxes. The blaze was quickly extinguished by means of sand, without serious damage being done; but a large number of fire-engines assembled at the spot.

Captain Robert Scott, the representative in the Birmingham district of Messrs. Alder and Mackay, Ltd., of Edinburgh, has now been demobilized from the Army, and has resumed his former duties; so that the firm's branch office at Central House, New Street, Birmingham, has been re-opened.

It is announced by the General Manager of the Ford Tractor Company, of America, that the Company are completing plans for the turning-out of gas-propelled tramcars, so as to replace the expensive electrically-driven tramcars by motor-driven cars. He expresses the opinion that the electric tramcar will soon be a thing of the past in all cities.

It is stated by the Secretary of the British Motor League (Mr. H. A. Scott) that the League have made arrangements to supply members with benzol of the best quality in any quantity at 2s. 6d. per gallon. At this price, the benzol (which is guaranteed to pass the National Benzol Association's tests) is delivered free at any address in London, or, in the case of country members, at any railway station carriage free.

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INVERTED BURNERS and CONVERSION SETS for Street Lamps.

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**A BRITISH Oxide Cheaper and Better** than Bog Ore. 85 per cent. Water, 75 per cent. Ferric Hydrate.
For Sale outright or on Loan.
OXIDE LIMITED, Brentford, Middlesex.

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**CHARTERED PATENT AGENTS AND** TRADE MARK AGENTS,
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Telegrams: "Patent, London." 'Phone: 248 Holborn.
And 8, St. Nicholas Buildings, Newcastle-on-Tyne.

**SEND your inquiries for Carburetted** HYDROGEN AND BLUE WATER-GAS PLANT, also TAR DEHYDRATING PLANT and other GAS-WORKS APPARATUS to—
**BALE AND HARDY,**
89, Victoria Street, Westminster, S.W. 1.

**JOHN RILEY & SONS, Limited, Chemical** Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 60 years. Reference given to Gas Companies.

**CORRESPONDENCE TUITION in GAS** ENGINEERING for City and Guilds Institute Exams. (Preliminary and Final). Successful Results. Low Fees.
Pennington's Engineering Tutors, 254, Oxford Road, Manchester.

## APPOINTMENTS, &c., WANTED.

**WHEN Filling Vacancies, please** REMEMBER THE CLAIM OF THE EX-SERVICE MAN, who, other Qualification being equal, has the FIRST CALL ON YOUR CONSIDERATION.

**ADVERTISER, shortly being Demobilized,** seeks Position as ASSISTANT ENGINEER or MANAGER—Gas or Mechanical Concern. Fourteen Years' Practical and Technical Experience. Silver Medalist Gas Engineering; Honours, Mechanical, Structural Engineering, Chemistry, &c. Young, Industrious, and Forceful.
Address No. 6630, care of Mr. King, 11, Bolt Court, Fleet Street, E.C. 4.

**ADVERTISER, shortly to be Demobilized,** DESIRES APPOINTMENT (with Gas Company preferred). Has had long Experience of Various Departments—viz., Stores, Rental, Coke, and Bye-Products. Highly Recommended.
Address No. 6639, care of Mr. King, 11, Bolt Court, Fleet Street, E.C. 4.

**GAS-FITTER, &c., used to Stove and** General Repairs. Two Years with last Company. Good References.
Address, "G.P.," No. 141, Turner's Road, Bow, E.1.

## APPOINTMENTS, &c., VACANT.

**RYDE GAS COMPANY.**

**APPLICATIONS are invited for the** Appointment of ENGINEER and MANAGER to the Company, with a knowledge of Reconstruction and Alteration to Works preferred.
Applications (which will be treated as confidential), accompanied by *copies* of not less than Three Testimonials of recent date, stating Age, Experience, Salary required, and present employment, to be addressed to the undersigned not later than May 6.
A. E. Coombes,
Secretary.
Ryde, I.W.,
April 16, 1919.

**No. 6598.**

**APPLICANTS for the Appointment** under the above Number are THANKED, and Informed that the POSITION HAS NOW BEEN FILLED.

**STRABANE URBAN DISTRICT COUNCIL.**

GAS MANAGER REQUIRED.

**THE above Council require a thoroughly** Practical Manager for their Gas-Works.
He will be required to read Meters, and must have had Experience in Working Regenerative Settings and Continuous Type Sulphate Plant. Age not to exceed 40 Years.
Salary, £160 per Annum, with free House, Coal, Light, and Garden.
Applications, stating Qualifications, Experience, date able to Commence Duties, also enclosing *copies* of Three recent Testimonials, to be received by the undersigned not later than May 6.
H. C. Gripton,
Engineer.
Gas-Works,
Strabane, co. Tyrone.

**GAINSBOROUGH URBAN DISTRICT COUNCIL**
(Gas Department.)

**WORKING Foreman wanted. Must** be a Good Carbonizer, with an All-Round Knowledge of Gas-Works Routine and Capable of Carrying out Ordinary Repairs and Maintenance of Plant.
Apply, stating Age, Experience, and Wages required, to J. Baldwin, Manager, Gas-Works, Gainsborough.

## PLANT, &c., FOR SALE & WANTED.

**FOR SALE—Two Belt Driven Exhausters,** 12,000 and 20,000 c.ft. per hour; also Tangye VERTICAL STEAM-ENGINES driving same.
Apply to W. J. Rendell Baker, Gas and Water Works, Devizes.

**FOR SALE—Washer-Scrubber,** 250,000 c.ft. per Twenty-Four Hours (Makers Messrs. R. & J. Dempster, Ltd.), and STEAM-ENGINE (Makers, The Bryan Donkin Company), in First-Class Working Condition.
Can be Inspected any time on Application to F. M. Paternoster, Gas-Works, Felixstowe.

**FOR SALE—Three Steel Cylinders** for Compressed Gas, 11 ft. long by 11 in. diameter, complete. Hardly used.
J. Pullar Phibbs, Ltd., North Strand, Dublin.

**SET of Four Purifiers, 22 ft. square by** 5 ft. deep. Very Good Condition, Ready for Delivery. Low offer accepted to save storing.
Firth Blakeley, Sons, & Co., Ltd., Church Fenton, *viâ* Leeds.

**EXCELLENT Set of 8 in. Vertical Pipe** CONDENSERS. Good Condition, Prompt Delivery. Eight inch Connections.
Firth Blakeley, Sons, & Co., Ltd., Church Fenton, *viâ* Leeds.

**"HOLMES" Patent Brush Washer-**SCRUBBER, with ENGINE for Driving. 6 in. Connections. Overhauled Ready for Delivery.
Firth Blakeley, Sons, & Co., Ltd., Church Fenton, *via* Leeds.

**WANTED, at once, Clerk with a** knowledge of Gas Office Routine. Salary, £120 per Annum.
Apply, stating Particulars, to the Secretary, Gas Company, High Street, Brentwood.

## COMPANY NOTICE.

**OTTOMAN GAS COMPANY.**

TO THE SHAREHOLDERS.

**NOTICE is Hereby Given that the** ORDINARY GENERAL MEETING of the Shareholders of this Company will be held at 59 & 60, Gracechurch Street, E.C., on Tuesday, May 13, 1919, at 12.30 p.m. precisely, to elect Directors and Auditors in place of those retiring, in accordance with the Articles of Association.
By order of the Board,
C. J. Daun.
Secretary.
59 & 60, Gracechurch Street,
London, E.C.3,
April 15, 1919.

**SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.**

**MESSRS. A. & W. RICHARDS beg to** notify that they hold PERIODICAL SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES.
Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to Messrs. A. & W. Richards, at 37, Walbrook, E.C. 4.

**TROTTER, HAINES, & CORBETT,** LIMITED.
BRETTELL'S ESTATE,
**FIRE-CLAY & BRICK WORKS,**
**STOURBRIDGE.**
Manufacturers of GAS RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every Description of FIRE BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
Shipments Promptly and Carefully Executed.
London Office: E. C. Brown & Co., Leadenhall Chambers, 4, St. Mary Axe, E.C.

**KENYON'S** PATENT **OIL FILTER** and **WATER SEPARATOR**
Over **900** ordered by H. M. Government.
ENGINEERS' STORES, TOOLS.
**ALEXANDER KENYON & CO.,**
Victoria Bridge, MANCHESTER.

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**GAS METER MAKERS.**
ORDINARY & PREPAYMENT METERS
Repairs and Conversion of Ordinary to Prepayment Meters receive prompt attention.
**LONDON & EDINBURGH.**

**SPARE PLANT FOR SALE.**

**GRAB** (Wild's Patent).
Capacity, half-yard.
In Good Condition.
PRICE £45.

**VERTICAL BOILERS**
1-150 galls. capacity.
1-100 galls. capacity.
PRICE £15 EACH.

**PILING FRAME**
By Sissons and White with monkey and chain. Drum 2' 0" x 6". Boiler capacity, 100 galls. Never used.
PRICE £70.

All the Articles may be inspected by intending purchasers. Apply to R.J.H., c/o W. H. Smith & Son, Stamford St., S.E.1.